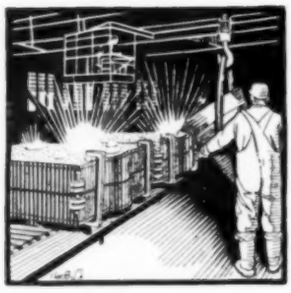


THE FOUNDRY

for August

Uncle Sam NURSEMAID

THOSE who have followed most closely the development of NRA have marveled at the ramifications of ideas set forth in the formulation of codes and their application. Social reform, theories old and new, pet hobbies and the amateur tinkering of a lunatic fringe that has been nurtured to mushroom growth in the sheltered damp of cloistered campus walks have made of NRA a complex, rambling structure far removed from anything visioned when the act was written.

Paternalism characterized by all the ills of fond favoritism for certain pets and oppression of ill-favored children has been apparent in some actions taken. Government paternalism, often harmless in intent, eventually can become the most abhorrent oppression. Many of the proposals and schemes brought forth or suggested partake of government paternalism.

Effective July 15, an executive order covering apprenticeship prescribes certain rules and procedures which if accepted will place the actual establishment and operation of apprentice training under a committee composed of three government appointees. These are to be designated by the secretary of labor and will include a representative from the department of labor, one from NRA and the third from the office of education. Further, as a basic consideration any apprentices employed under rules to be promulgated will be over 16 years of age, and will be hired under a written contract with an employer or a group of employers providing for at least 2000 hours of "reasonably continuous" employment.

It will be apparent at once that the ramifications of this scheme presuppose bureaus for establishment and administration. The minimum of 2000 hours training is woefully inadequate in which to learn a skilled trade. The system required would involve endless governmental red tape and meddling. The control and advancement of individual apprentices would be open to all the machinations of supervisors and inspectors. Fundamentally, it is doubtful if an individual apprentice would have a chance under the complications of such a setup to enter upon a projected training course in the period between his sixteenth and eighteenth birthdays. And with another government bureau busily engaged in setting forth "hazardous" occupations upon which an apprentice could not be employed, he probably could only apply his 2000 hours at emptying wastebaskets containing his employer's orders, instructions, reports and revisions of policy determinations emanating from the national, regional, state and local compliance offices. Even this occupation might become hazardous in the presence of an irascible, and harrassed employer.

Governmental supervision of apprentice training is paternalism. It is only a few years removed from assigning to the state the responsibility for state controlled, collective child raising.

Value in FAILURES

POSTMORTUMS are messy. They don't restore the subject to a life of usefulness. Often, they prove embarrassing to the one that is responsible for the deceased's condition and sometimes they are a nemisis to one at fault. However, they perform a useful function. They give accurate information as to the cause of the decease. Foundry postmortums also are messy, the defective casting must be destroyed to yield clews to the reason for failure and many times the responsibility is brought home to someone at fault, with painful results. But a study of defectives does serve a most useful function. A shop clinic, holding frequent postmortums over defectives is a valuable aid to improvement in practice. Co-operation between foundries making similar work, through the agency of competent technical men has proved to pay dividends in improvement of product. More general study of failures and defects is needed. Such investigations are even more valuable than the exchange of information covering approved practice or high accomplishments.

Controls Cupola Melting Operations

Standards established in plant producing high test gray iron machine tool castings

By FRANK G. STEINEBACH

WHILE our modern civilization depends almost entirely on machine tools for the production of the necessities and luxuries of life, progress in the machine tool industry since the turn of the century has been possible only through many remarkable developments in the art of founding. Castings possessing properties to meet every demand have been provided as machine tool manufacturers, over a period of years, have developed machines, from the small, simple tools to the many complex mechanisms of today.

Physical properties must be given careful consideration in providing gray iron castings for machine tools. Greatly increased cutting speeds resulting from the introduction of new types of cutting tools, have provided a demand for machine tool castings possessing high tensile strengths. Since resistance to wear is an exceedingly important factor in certain parts of the tools, grain structure and hardness must be well under control. To obtain machinability the iron structure should have a matrix of pearlite, with no free cementite present. Of course, the ability which gray cast iron possesses to absorb or dampen vibration adds greatly to its value as an engineering material in the design of machinery of all kinds.

Company Has Developed Standards

Complete control of all foundry operations, with perhaps special emphasis on melting and molding, is an absolute essential in the production of the most satisfactory castings for the machine tool field. Through experimentation, research and consultation with authorities in the field, the St. Marys Foundry Co., St. Marys, O., over a period of years, has developed standards which permit complete control of operations and insure uniform results days after day. That company produces a wide range of high test gray iron castings for machine tools, supplying its affiliated companies and also the jobbing trade. The company produces castings ranging from 50 pounds to 12 tons, and the plant has a capacity of approximately 20 tons of cleaned castings a day.

Methods of controlling melting operations provide the most interesting features of the plant. Years of experience in machine tool work have provided the knowledge for establishing standards to cover every detail of practice, so that both uniformity and quality of product can be secured throughout the heat and from day to day. Excellent supervision is provided, and extensive records are kept, so that any variations from standard may be discovered and corrected quickly. The metallurgist plays an important part in the control program, first in assisting in the establishing of standards and then in providing chemical and physical tests to maintain a continual check on operations.

Metal is melted in a cupola recently installed

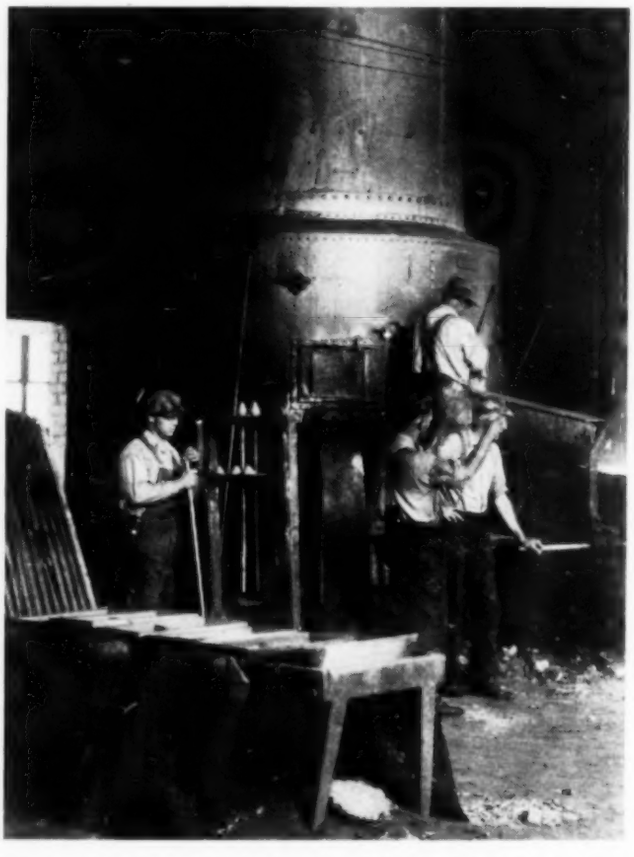


Fig. 1—The company believes a definite schedule for tapping permits greater ease in handling metal from the cupola

along one side of the main bay, between the molding and cleaning departments. The furnace is lined to 48 inches and is boshed at the tuyeres to 36 inches. It is believed that the bosh permits the air more nearly to follow the center of the cupola and therefore gives better melting conditions. The bottom of the tuyere line is 11 inches above the sand bed. The tuyeres are 5 inches high and 11 inches wide, and are flared to make a complete opening in the lining. Natural fire stone is used as the lining in the melting zone, and fire brick is applied in the remainder of the stack.

Previous experience had shown that many difficulties of cupola operation result from having the charging door too low. In the belief that the charging door in a cupola of that size should not be less than 16 feet above the sand bed, those in charge of the plant decided to increase that height to provide greater flexibility. Therefore the charging door was located 20 feet above the bed, which holds the top charge from 2 to 3 feet below the charging door. It is interesting to note that the company first decided on the height of the charging door to provide most efficient operation, allowing greatest control, and then constructed the charging floor, elevators and other features to fit that particular height.

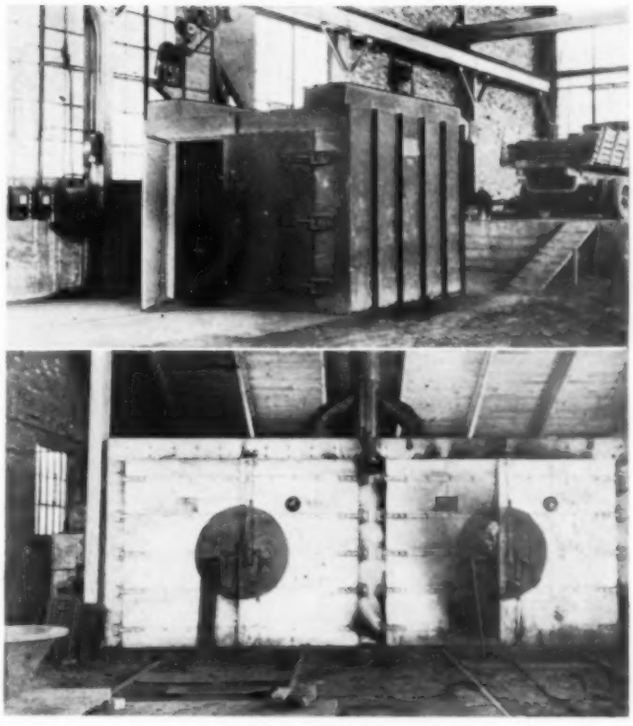


Fig. 4 (Above)—Room type blasting equipment located between the molding and shipping departments. Fig. 5 (Below)—Temperatures in the two oil fired core ovens are controlled automatically

Fig. 2 (Above)—Micrograph of iron having tensile strength of 47,000 pounds per square inch, X100. Fig. 3 (Below)—Same iron etched with 2 per cent nital, X500

Extreme care is exercised in patching the cupola to see that the diameter is the same for each heat. Templets are used daily to check the accuracy of the repair work. When it is considered that several inches increase in the diameter of the cupola will lower the bed and introduce the danger of oxidizing the iron, the necessity for maintaining the lining dimensions uniform is apparent.

The coke bed is 60 inches above the tuyeres, and is lighted with wood. The wood is placed in the cupola as nearly as possible in the same manner from day to day and the melting foreman must check the bed to see that it is burned through properly before a charge is placed in the furnace. That inspection quickly shows if the bed has been lighted according to established standards, and provides the necessary information to correct any variations. By-product coke is used in melting.

Materials are charged in the cupola in layers in the following order: Coke, limestone, briquets, steel scrap, pig iron, and returned scrap. The recommended practice is to charge the limestone on the coke, where it can be distributed more uniformly. Thirty-five pounds of limestone is added to each 2000 pound charge. Materials are stored in the yard in the rear of the cupola and served by a railroad siding. All charges are weighed in the yard, placed on pans and carried to the charging floor on an elevator. Contemplated improvements in the yard will aid materially in handling the raw materials to the

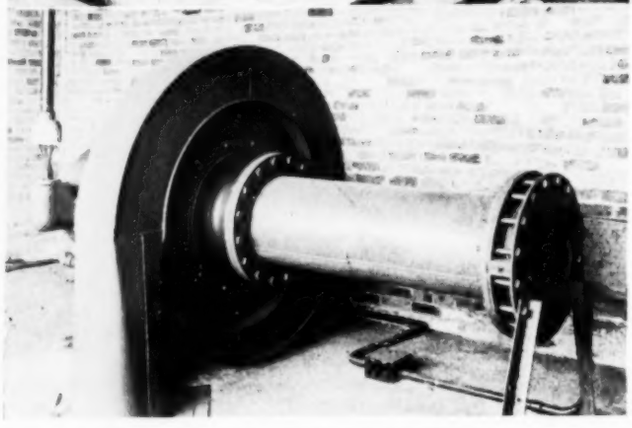


Fig. 6 (Above)—Special refractory shapes are used to obtain teapot type ladles. Fig. 7 (Below)—The blower supplies air to the cupola by weight

charging floor. A young high school graduate, with training in the foundry is stationed on the charging floor at all times when the cupola is in operation to see that the raw materials are placed in the cupola properly. The company believes that such supervision is exceedingly profitable as an aid in securing exact control.

As high as 50 per cent of steel scrap is used in the charges, the amount depending on the type of iron being produced. Only steel rails are used, and these must not exceed 18 inches in length. The charging supervisor must see that the rails lie flat on the coke charge, since if allowed to stand on end, they would extend through two charges and would not melt properly. Two grades of bessemer pig iron are used, one containing 2 per cent and the other 4 per cent silicon. Wherever possible, alloys are added in the cupola in the form of briquets.

A definite weight of air is supplied to the cupola by a blower equipped with an automatically controlled weighing device, which compensates for changes in temperature and barometric pressure. Shortly after that equipment was installed, the management had an opportunity of observing the action of the automatic control under rapidly changing atmospheric conditions. Just before the blast was turned on one afternoon, when both the temperature and humidity was high, the plant manager noticed that a storm was approaching. He went to the blower room, and observed that when the blower was started, the automatic control opened the damper much wider than ordinarily was the case, indicating that an exceedingly large volume of air was being delivered to the cupola. Shortly after the storm broke the damper started to close, and after the rain was over, the opening was considerably less than when the blower was started, due to changes in both the atmospheric temperature and pressure. The rate of melting remained the same and the temperature readings and test bars did not show any variation throughout the heat.

Set Time Schedule for Tapping

The well of the cupola holds exactly one ton of molten metal, so that when a small trickle of iron appears at the slag hole, the first heat is tapped. Since all of the factors entering into the cupola operation are controlled definitely and standards of practice are followed exactly, it has been possible to set a time schedule for melting and tapping which will vary only slightly in one direction or the other. If the iron is melting either too fast or too slow, as shown by observation of the slag hole, the foreman on the floor knows that some variation has been made in the coke charge, and steps are taken immediately to bring the melting rate back to the normal schedule.

The company believes it important that the metal be handled just as soon as it is ready to be tapped. With a definite time schedule for tapping, it becomes easier to have ladles and cranes at the spout when the iron is ready to handle it to the molds. Temperature readings are taken at the spout and on the most important castings readings are taken at the beginning and the end of pouring. The management believes that too rapid a drop in temperature shows that the iron is being oxidized. Temperature of the metal at the spout, as taken with an optical pyrometer, is from 2900 to 2925 degrees Fahr. While the instrument is checked frequently by the manufacturer for (*Please turn to page* 44)

Fig. 8—The plant is well equipped with cranes for handling materials in the various departments

Plan Tour for Overseas Visitors

Itinerary for European party attending congress covers large industrial centers

OVERSEAS foundrymen visiting the forthcoming Fifth International Foundry congress will have an unusual opportunity, within a short space of time, to inspect and study a cross section of American foundry practice. From the time they leave the eastern coast following their arrival on Oct. 10, until they again embark for their various homelands on Oct. 27, these distinguished Europeans will have available for their interested inspection examples of practically all phases of castings manufacture.

Recalling the courtesies extended in 1926, at the time of the second International congress, many who are repeating their visit anticipate renewing personal contact with American friends. The exchange of information and experiences between those engaged in similar lines of work has proved the value of the international contacts.

The pre-convention tour of the overseas party will cover the period from Oct. 10 to 22, extending from the debarkation in New York until the arrival in Philadelphia. It will embrace Buffalo, Chicago, Detroit, Cleveland, Pittsburgh and Washington, enroute, with preferential foundry inspection trips to Milwaukee, Saginaw and adjacent cities where a number of the large shops of special interest have been made available for visitation.

To provide a variety of types and classes of work some of the leading manufacturing establishments have offered to receive parties of visitors. These include plants making various classes of jobbing work and specialties in gray iron, steel, malleable, brass and aluminum castings, ranging from heavy machinery and rolling mill equipment to stoves, radiators and automotive parts. A tentative list of plants available for inspection includes the following:

BUFFALO—Bingham & Taylor Corp.; Atlas Steel Casting Co.; Jewell Steel & Malleable Co.; Pratt & Letchworth Co.; Otis Elevator Co.

MILWAUKEE—Allis Chalmers Mfg. Co.; Falk Corp.; Liberty Foundry Co.; Harnischfeger Corp.; Milwaukee Steel Foundry Co.; Sivyer Steel Casting Co.; Spring City Foundry Co.; Bucyrus-Erie Co.; Motor Castings Co.; Badger Malleable & Mfg. Co.; Belle City Malleable Iron Co., Racine, Wis.

DETROIT—Cadillac Motor Car Co.; Chrysler Corp.; Detroit Steel Casting Co.; Detroit Gray Iron Foundry Co.; Ford Motor Co.; Magnus Co.; Michigan Steel Casting Co.; Packard Motor Car Co.; U. S. Radiator Corp.

SAGINAW—Chevrolet Division, Gray Iron Foundry; Saginaw Malleable Iron Division, General Motors Corp.

CLEVELAND—Crucible Steel Casting Co.; Chandler & Price Co.; Eberhard Mfg. Co.; Cleveland Co-operative Stove Co.; Forest City Foundries Co.; Glauber Brass Mfg. Co.; West Steel Casting Co.

PITTSBURGH—National Bearing Metals Corp.; Pittsburgh Equitable Meter Co.; Union Steel Casting Co.; United Engineering & Foundry Co.

During the tour opportunity will be given to see the points of civic and historical interest in each of the large centers. A day in New York with special trips will be followed by a night ride to Buffalo. The day following will be spent in plant visitation and in a trip to Niagara Falls where an oportunity will be given to view the falls by night illumination before departing by night train for Chicago.

Visitors Will See Century of Progress

The visitors will have an opportunity to see the city of Chicago by a conducted tour, followed by a visit to the Century of Progress exposition, with a full day provided for elected trips to Milwaukee's foundry area. Similarly, in Detroit, an additional day will be provided for the side trip to Saginaw. The party then continues to Cleveland by steamer, thence to Pittsburgh and with a daylight ride through the scenic section of Pennsylvania to Washington, where two days will be given to sightseeing in the nation's capitol prior to the arrival at the convention, Oct. 22.

Special courtesies will be extended to the visitors during the convention week. The technical sessions will include in their programs a number of papers from the foreign associations and the value of the discussions will be increased by the worldwide viewpoint which will be offered upon foundry technical problems. The main party of European delegates will sail from New York, Saturday, Oct. 27 for their respective homes.

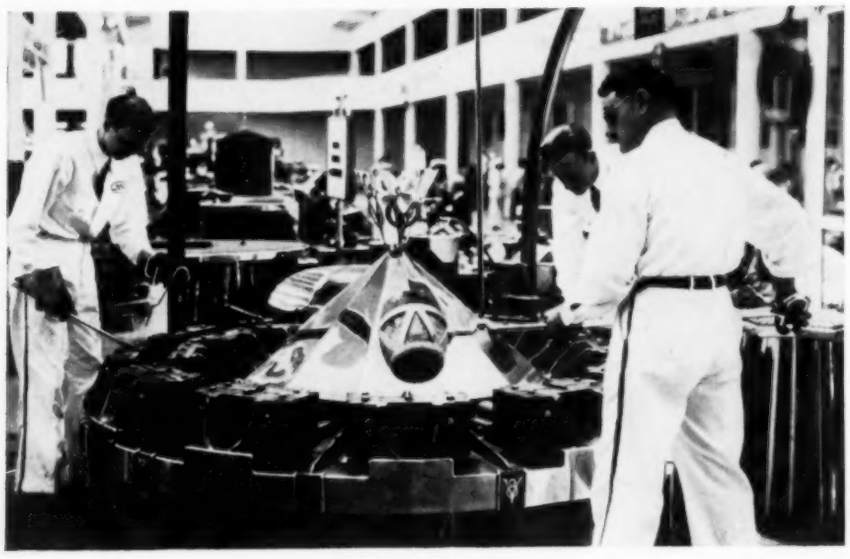


Fig. 1—A permanent mold machine, embellished with stainless steel, is in operation producing valve tappets

Ford Runs Foundry at the Fair

Casting of electrically melted iron in permanent molds makes spectacular show

CASTING molten iron in permanent molds provides one of the most interesting and spectacular displays in the mammoth Ford exposition at the Century of Progress in Chicago. In a new building erected this year and said to be the largest ever maintained at an international exposition by a sigle exhibitor, the Ford Motor Co. is attempting to show the "how" of progress; how things are made, how things are done, how modern civilization advances.

The sign which describes to the visiting public the purpose of the 60-foot island in the Industrial hall on which the casting of valve tappets for the Ford V-8 car is illustrated, gives Henry Ford's idea of the importance of iron and steel and the process of casting metals as follows: *Iron—the most precious metal—foundation of manufacture —easily cast and machined—basis of many alloys.* In naming iron as the most precious metal, Ford casts over the iron and steel worker the glamour which formerly belonged to the workers in gold, and precious stones.

A feature of this display, which always attracts a crowd of visitors when in operation, is the 500-pound, direct arc type electric furnace in which the iron is melted. From the furnace, shown in Fig. 2, the molten metal is taken to a rotary table on which is mounted 12 heads for casting valve tappets, as is shown in Fig. 1. This machine presents a complete cycle of operations including cleaning the mold, application of a coating of carbon from an acetylene flame, setting cores, pouring, and (*Please turn to page* 47)

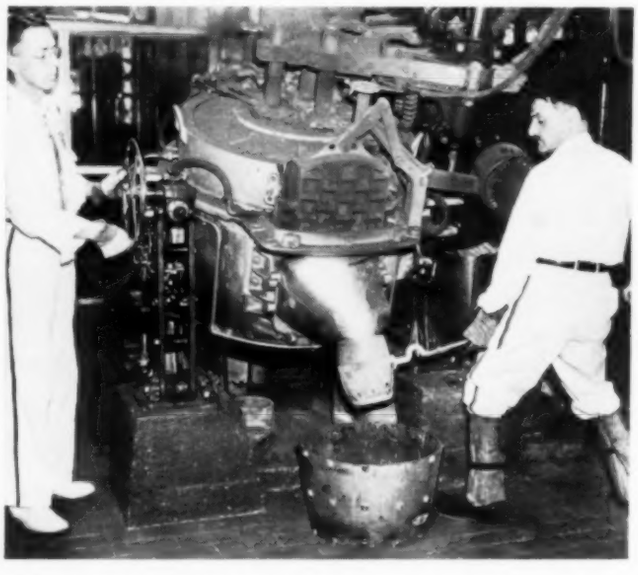


Fig. 2—Iron is melted in a direct arc type furnace located in Industrial Hall

Criticizes Gray Iron Costs

Simplified procedure urged to permit use by small foundries. Questions estimating method

By ROBERT GRAY
University of Pennsylvania

PROPER knowledge of cost is necessary to the operation of any successful business. Standardization in cost procedure is desirable and long has been sought in the foundry industry. Whether uniformity should be enforced through the authority centered in NRA, without a complete agreement and most careful study is open to question, as stated by the author in the article following. Accordingly, to further study and discussion of this most important problem Mr. Gray's criticism is presented, although THE FOUNDRY does not agree with many of the points which he raises.

THE EDITORS

I WISH to present certain facts which will show that any compulsory uniform cost and estimating system for the gray iron foundry industry will be to the detriment of many who either directly or indirectly are dependent upon that industry for their living.

The market for gray iron castings produced by a particular foundry is usually confined to a comparatively small geographical area. The product is generally too cheap to stand the addition of much cost of transportation. Thus, most castings used in Philadelphia are produced in or near the city. Even foundries in the same area do not necessarily compete. Specialization of foundry work has reduced still further the competition within the industry. The proposed uniform cost and estimating system recognizes these differences when it recommends different methods of computing cleaning and shipping costs in shops handling heavy, light, and both light and heavy work.

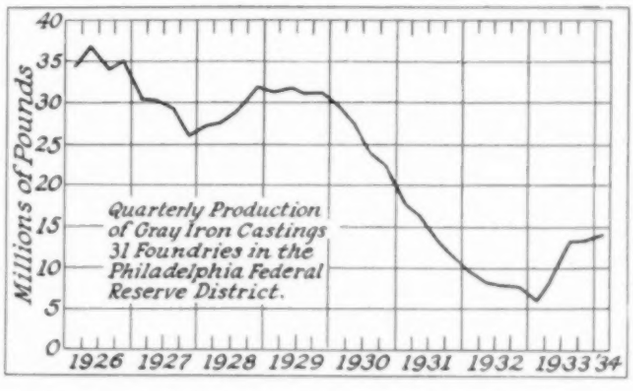
If competition had been confined to comparable gray iron foundries located in the same area, it is probable that "cut-throat" competition would not have developed. However, in seeking business producers of gray iron castings have often been forced to bid against malleable iron and steel foundrymen and against manufacturers of stamped, forged, welded, or rolled products. It is natural that price cutting would develop from this competition with different materials and different processes.

A uniform cost and estimating system for the gray iron foundry industry undoubtedly would result in a more intelligent competition among comparable gray iron foundries in each area, but it would not limit the competition from malleable iron and steel foundries and from other processes. The gray iron foundry industry cannot afford to bind itself by rules which do not apply to all of its competitors: Rigidity of prices for gray iron castings would only accelerate the shift to malleable iron and steel castings and to stamped, forged, pressed, and welded products.

The inadequacy of all accounting systems and the complexity of the competition faced by gray iron foundries are facts which should be considered before any uniform cost and estimating system is incorporated into the Code of Fair Competition for the gray iron foundry industry.

If the industry wishes to adopt a uniform cost and estimating system or if the administration wishes to encourage one in the industry, there are certain facts concerning the proposed uniform cost and estimating system which should be considered.

Even the simplified procedure is too complicated for many of the small foundries. The clerical staffs of many foundries are not sufficient to permit the installation of such a cost system. The financial position of many foundries will not permit the addition of more overhead. The competition from other industries will not permit increases in prices to (*Please turn to page* 52)



The foundry industry, due to the nature of the product, is subject to cyclical fluctuations

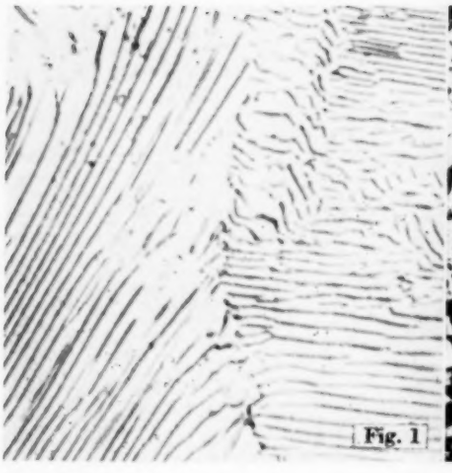


Fig. 1

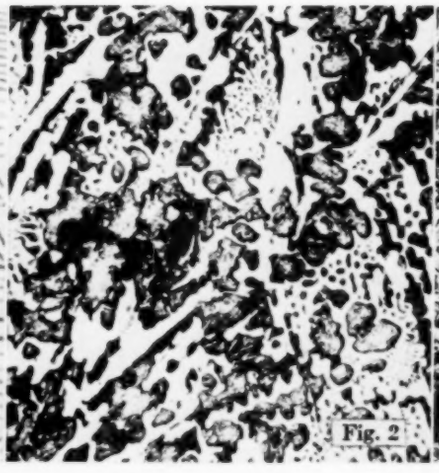


Fig. 2

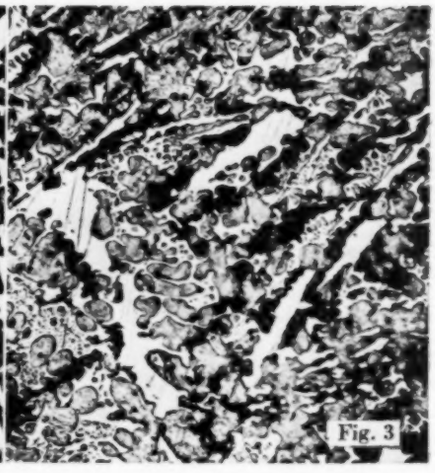


Fig. 3

Fig. 1—Pearlite in gray iron, etched with picric acid, X1000. Fig. 2—White iron, with free cementite showing white, etched with picric acid, X100. Fig. 3—Mottled iron, with white indicating cementite, black graphite and gray pearlite, etched with picric acid, X75

Heat Treatment of Cast Iron

Undertaken to relieve internal stresses or to change the structural constitution

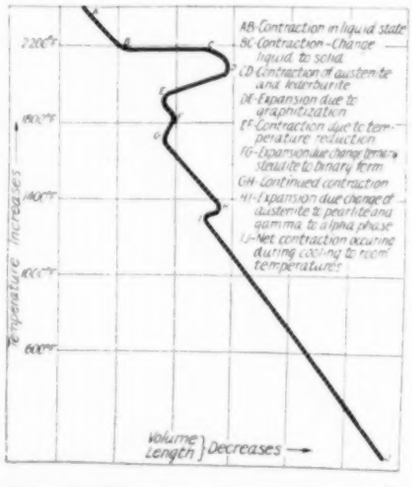
By JOHN W. BOLTON

IN A broad sense, the term *heat treatment* implies any thermal treatment intended to alter the properties of a material. For example superheating molten cast iron might be considered a heat treatment. Likewise, pouring molten metal into heated molds or against chills provides thermal treatments at variance with the usual foundry practice of casting gray iron into sand molds.

In the narrower and more usual sense the term, as applied to gray iron, means thermal treatment to which rough semifinished, or finished castings may be subjected. The term heat treatment as employed in this discussion is confined to the latter restrictive definition.

Heat treatments of gray iron are undertaken either to relieve internal stresses or to change the structural constitution and modify the physical properties of the metal.

During the cooling of cast metal, contraction takes place. Since cooling rates even in simple sections are not uniform throughout, different parts usually tend to contract different amounts. In certain cases there arises conditions wherein at a given time some parts may be contracting and others expanding. Shortly after solidification of normal cast iron the rapid formation of graphite results in an actual expansion in excess of the normal contraction tendency. There is a later expansion when austenite changes to pearlite. The contrac-


AB-Contraction in liquid state
BC-Contraction-Change liquid to solid
CD-Contraction of austenite and interburite
DE-Expansion due to graphitization
EF-Contraction due to temperature reduction
FG-Expansion due change from austenite to binary ferrite
GH-Continued contraction
HI-Expansion due change of austenite to pearlite and gamma to alpha phase
IJ-Net contraction occuring during cooling to room temperatures
Temperature increases
Volume Length } Decreases

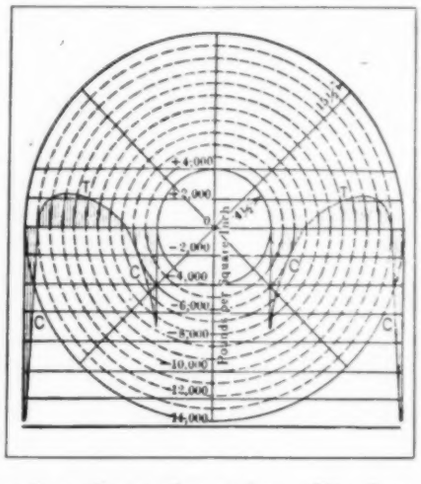


Fig. 4—Diagram of expansion and contraction effects of cast iron. Fig. 5—Shrinkage stress in cast iron cannon 11 inches thick, according to Johnson

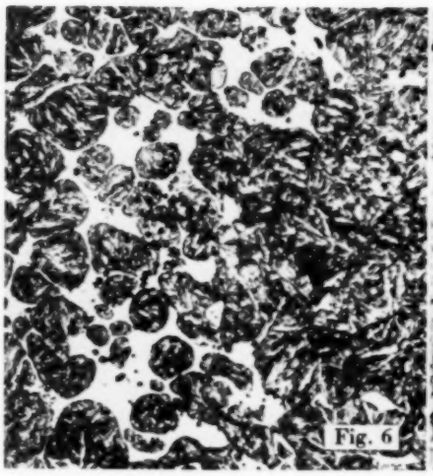


Fig. 6—Sample originally gray iron quenched from 2000 degrees Fahr. Note reappearance of white cementite, etched, X100. Fig. 7—Gray iron quenched from 2000 degrees. Etched, X1000. Fig. 8—Martensite is shown as gray needles and austentite as white. Etched, X2000

tion curve is shown in Fig. 4. The net result is the creation of internal stresses with consequent likelihood of warpage or even of fracture. Years ago the late J. B. Johnson made an interesting analysis of stresses in a heavy simple cylindrical shape, a section of a cast iron cannon, metal section 11 inches thick. The analysis from his book, *Materials of Construction,* is shown in Fig. 5. The exterior and bore contracting before the center sections put the interior surface under a compressive stress of 7000 pounds per square inch, the exterior to 13,500 pounds per square inch, the center under a tensile stress of 2000 pounds per square inch. These stresses were ascertained by cutting out a series of concentric rings, measuring distortion of same before and after cutting.

In case of castings like large gears with spokes, casting parts connected by webs etc., these stresses sometimes break the casting. While with uneven sections there is more danger of cracking long thin parts connected rigidly to heavy ones, cracking even occurs in smaller castings. The author recalls a truck bell housing with light and fairly uniform sections but heavily webbed which showed a large percentage of breakage during handling and machining. Cutting through from the periphery to the central opening the saw cut sprung open over an eighth of an inch. The fragility of this casting was eliminated by redesign, but could have been ameliorated by quick aging.

Warping is a not uncommon phenomenon. This more frequently is noted after machining, the equilibrium of stresses being disturbed by the removal of metal. Although redesign often can be resorted to, warping not infrequently is noted in simple sections.

Years ago the practice of aging was employed, castings being laid away for weeks and even months before machining. Later, it was found that stresses could be relieved by heating to moderate temperatures and slowly cooling. As shown in Fig. 9, the rigidity of cast iron decreases with increase in temperature. At temperatures of 700 degrees Fahr. or there-abouts sustained loading will produce permanent plastic deformation or flow—the rate increasing with increase in temperature. The internal stresses furnish the sustained loading until they are dissipated by strain or strain relief.

From a survey of the literature it appears that L. M. Sherwin (THE FOUNDRY, Oct. 1917) prepared the first scientific paper on quick aging of castings by drawing or strain relieving as it sometimes improperly is termed. Sherwin experimented with various temperatures from 150 to 1800 degrees Fahr. Most effective results were obtained within the range 400 to 1100 degrees Fahr. The author's experiments with heavy castings (1921-1922) indicated that 700 to 1000 degrees Fahr. is a good range for that purpose. Castings up to 25,000 pounds were treated successfully. Extended periods at or above 1000 degrees Fahr. usually cause some graphitization and softening. Below 700 degrees Fahr. the action may be rather slow in some cases, so that 900 degrees Fahr. is a preferred temperature. Length of time at temperature depends on the particular casting, and periods from 2 or 3 to 12 hours

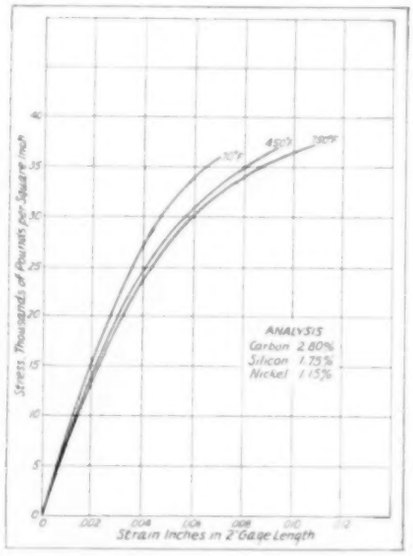


Fig. 9—Comparative stress-strain diagram of gray iron at elevated temperatures

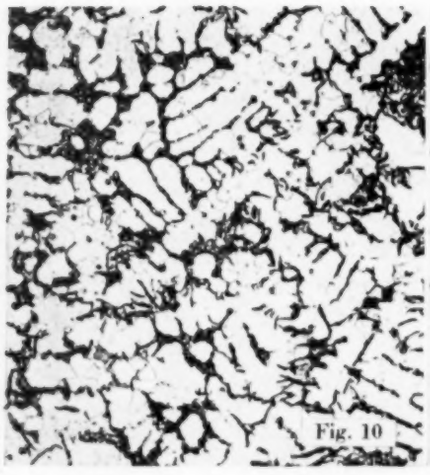


Fig. 10

Fig. 11

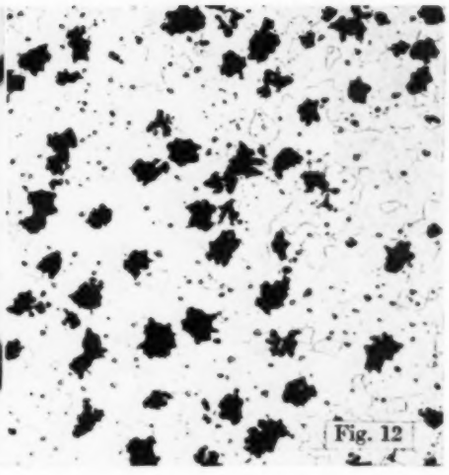


Fig. 12

Fig. 10—High carbon cast iron completely annealed. Structure is ferrite and graphite, with strength low. Etched, X100.
Fig. 11—Reabsorption of steadite on long anneal. White particles are remnants of steadite particles. Etched, X625.
Fig. 12—Structure of malleable iron

or more have been employed. The period at maximum temperature should be followed by slow cooling in the furnace.

Claims have been made that the phenomenon of permanent set noted on loading cast iron does not appear in irons whose internal stresses have been removed. Experiments by the author (THE FOUNDRY, May 1, 1930) disprove that generality, stress relieved iron and as cast iron from the same ladle showing the same permanent set.

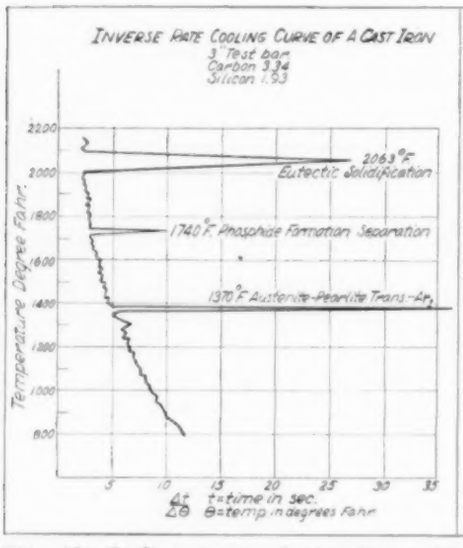
Castings subjected to acid pickling not infrequently are somewhat embrittled. Such embrittlement can be dissipated by heating 2 or 3 hours at 300 to 400 degrees Fahr.

Intelligent heat treatment of cast iron demands some knowledge of its structural formations. For simplicity, discussion of direct graphitization according to the stable system has been omitted from this article. Molten cast iron consists of iron with carbon and other elements in solution. Under usual conditions as the metal freezes a saturated solid solution of carbon in iron, known as austenite, and free cementite or iron carbide (Fe_3C), are formed. In the presence of sufficient silicon etc. unless cooling is very rapid the free cementite breaks down rather rapidly, one of the products of this decomposition being graphite. The action is most rapid just below the final solidification point and there the flakes are relatively free to assume a natural or idiomorphic form. As cooling continues the solubility of carbon in austenite is lowered and the excess is rejected as cementite. This may be broken down, wholly or in part to graphite and other products.

In irons whose composition and cooling rate are such that they will be gray iron, the usual structure at say 1400 degrees Fahr. consists largely of austenite and graphite. As this temperature the austenite holds about 0.60 to 0.90 per cent carbon in solid solution. Austenite itself is soft and nonmagnetic. When the temperature drops further a marked change is noted at about 1380 to 1325 degrees Fahr. in plain gray irons. An evolution of heat within the metal retards the cooling rate, and the material becomes magnetic. This phenomenon, occuring at 1380 to 1325 degrees Fahr. on cooling, is known as the austenite-pearlite transformation or more briefly the pearlite transformation or Ar_1 point.

In pearlite the combined carbon is no longer in solid solution but occurs in fine cementite plates in a ferrite matrix as shown in Fig. 1. The pearlitic or eutectoid structure ordinar-

(*Please turn to page* 48)



REACTIONS AS CAST
QUENCHING and DRAWING
ANNEAL and SLOW COOL
Finel Solidification
Rapid Graphitization
Sep. of Phosphide Rich Component
Quench Results in Re-Appearance of Cementite
Soft and Coarse Grain Action Rapid
Best Quenching Range
Pearlite Transformation
No Hardening from Quench Below This Range
Soft and Fine Grain Action Rapid
Slow Graphitization Possible
Most of Gain in Hardness and Strength Lost in Draw
Soft and Fine Grain Slow Graphitization
Draw Gradually Lowers Strength and Hardness
No Further Structural Changes
Best Ageing Range
Maximum Strength Attained on Draw
Draw Produces Loss in Hardness and Gain in Strength
Draw Produces No Perceptible Change
Temperature Degree Fahr.
EFFECT OF VARIOUS TREATMENTS ON PLAIN CAST IRON

Fig. 13—Cooling curve of cast iron. Fig. 14—Chart showing reactions of iron at various temperatures

Removes Dust at the Shakeout

Both blast and suction action provided in equipment through parallel wind boxes

By W. G. GUDE

A SYSTEM for eliminating dust, recently placed in operation in the brass foundry of the Sloan Valve Co., Chicago, effectively controls dust-producing equipment so as to give the plant an atmosphere unusually clean.

Equipment shown in the accompanying illustration, is designed to remove dust at the shakeout, usually a troublesome point. This unit consists of a high-speed fan, two wind boxes located on opposite side of the shakeout, a preliminary and secondary dust collecting hopper and a blow pipe. One wind box exerts a blowing action, the other suction. The fan, supplying the wind for the blast as well as for the suction, separates all the heavy dust and deposits it in the dust collecting hopper.

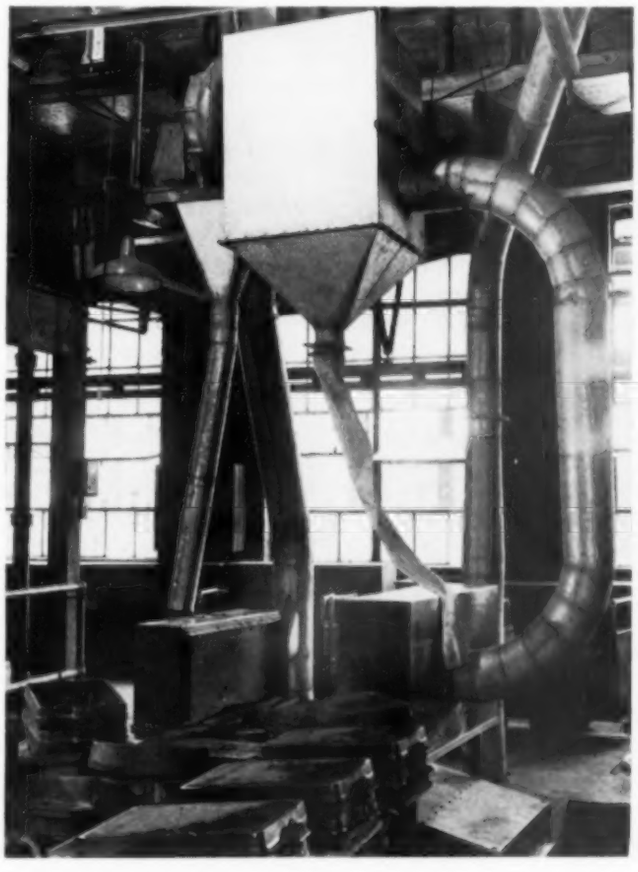
The blast box is located along the full length of the shakeout and is about 2 feet high and 10 inches deep. Welded seams make the box air tight. A face built about 1-inch from the edge facing the shakeout has a ⅛-inch slot on the top and two sides. A blast of air from the slot prevents prevailing dust from rising, blowing it instead to the other side of the shakeout, where it is drawn into the suction box.

System Combines Blast and Suction

The latter box combines blast and suction. Wider and higher than the opposite box, it is open on the side facing the blast, and in this face is imposed a four-sided funnel tapering into a suction pipe at the back. Outer edges of the funnel are built about 1-inch from the box, while edges of the box are curved to turn in parallel with, but spaced about ¼-inch from, the faces of the funnel. The space inside the box and back of the funnel also is used as a blast box, the wind traveling around the outer edge of the funnel and being guided by the turned-in edges of the box. As the edges turn in, the blast is directed to the center of the funnel or suction opening, thereby preventing a rebound of dust particles that are blown into the funnel from the blast side.

This blast also is supplied by the fan, the blast pipe being carried from the blast side under the floor to the suction side where it is connected with a gate to control the volume. Suction for the funnel is derived from the suction side of the fan. The suction pipe is not connected directly to the fan but is equipped with a hopper directly over the shakeout. This hopper, the preliminary collector, collects the heavy particles that may be returned to the heap sand.

Passing through the cycle the wind from the suction at the back of the funnel leads into the preliminary collector hopper where the heavy particles drop, then on through the fan which by the centrifugal action of the impellor separates the dust particles (*Please turn to page* 59)



Blast from the smaller box drives the dust to the suction box on the opposite side of the shakeout

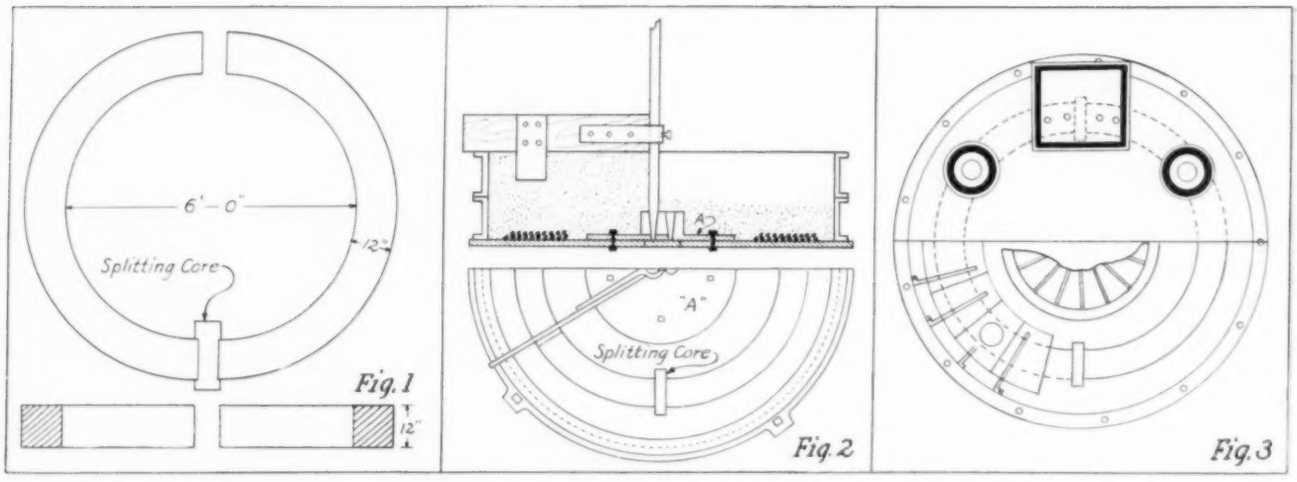


Fig. 1—Plan and section of typical ring casting. Fig. 2—Method of sweeping ring in a flask. Fig. 3—Composite view of assembled ring mold

Sweep Split Molds Off Two Centers

By J H. EASTHAM and J. McVEY

FOUNDRIES specializing in mill and mining repairs and general engineering work of a heavy class, frequently are called upon to produce a pair of split castings—flywheels, pulleys, winding drums, rings, etc.—at short notice and under circumstances which either do not allow time to wait for a pattern, or the contract price for a single pair of castings may not justify the construction of a pattern which never may be used again.

In instances of this kind the principle of sweeping up an oval mold is resorted to, by methods which if properly carried out, permit extreme accuracy to be attained. It is not uncommon to find two halves of a casting produced in this manner to show a weight variation of less than a pound.

May Use Either of Two Methods

A typical pair of half castings machined to 8 feet outside diameter, 12 inches thick and 12 inches deep is shown in Fig. 1. In the rough with gates and risers the castings weighed over 10,000 pounds. Either one of two methods might have been employed in sweeping the molds for these castings. In the first a double spindle socket is employed and the spindle is shifted from one to the other to secure the necessary thickness between the two halves of the mold for the splitting cores. In the second method the same result is secured by revolving the sweep arm around an eccentric block mounted above a collar attached to a stationary spindle.

The double spindle socket used in the first method is shown in Fig. 2. In some instances a

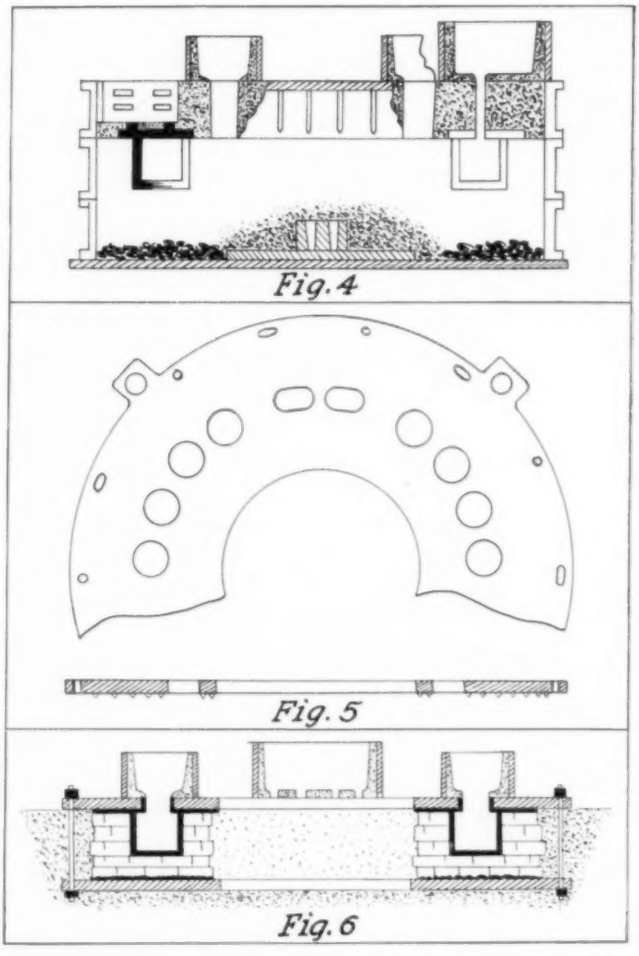


Fig. 4—Typical arrangement of gates and risers. Fig. 5—Plan and sectional view of loam plate. Fig. 6—Sectional view of loam mold assembled below floor line

socket with a three or four arm base will serve, but greater stability is assured with a plate 2 to 3 feet in diameter which may be bolted to a bottom plate of a flask or pit.

The mold for the casting shown in Fig. 1 may be formed with sweeps, but the work will be facilitated greatly by the adoption of a short section of pattern. The distance between the socket center lines is optional, so long as the molder bears in mind that this distance equals the thickness of the splitting cores. The usual distance is 4 inches.

In molding the casting shown in Fig. 1 a cinder bed was spread over the bottom plate to correspond approximately to the shape of the casting. The spindle was set up in one of the sockets and the other socket was stuffed with waste. Black sand was rammed to within an inch of the sweep board. The remaining distance was covered with facing sand, tramped down and vented. The surface then was swept to form the bottom face of the mold and incidentally a seat for the pattern segment which replaced the sweep.

Before the sockets are covered with sand, suitable marks are set up for guides in drawing center lines on the swept bed. Where the socket is left exposed inside a flask ring or other suitable curbing, this precaution is not necessary.

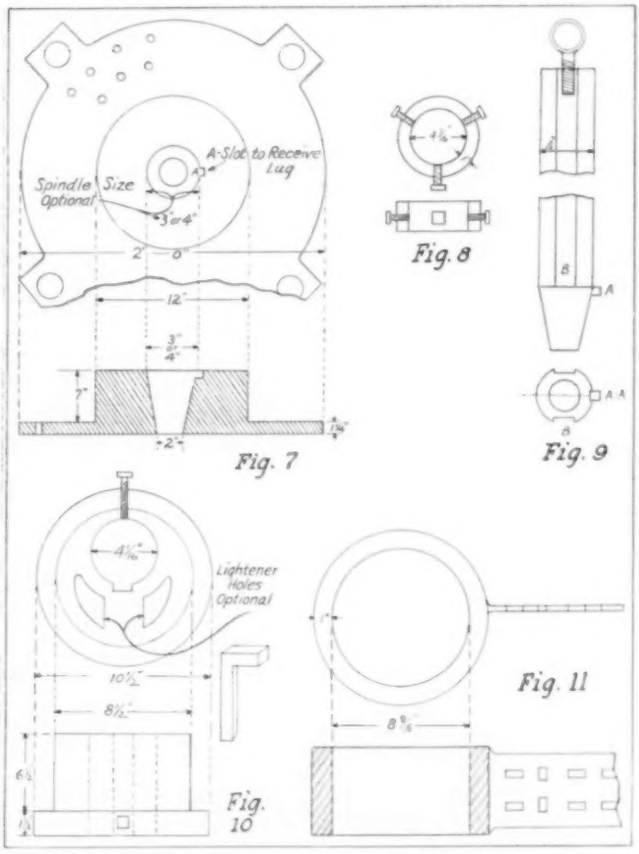


Fig. 7—The base is provided with a socket and keyway for anchoring spindle. Fig. 8—Collar for supporting eccentric block. Fig. 9—Spindle is slotted on opposite sides. Fig. 10—Eccentric block and key. Fig. 11—The sweep arm is bored to fit around the eccentric block

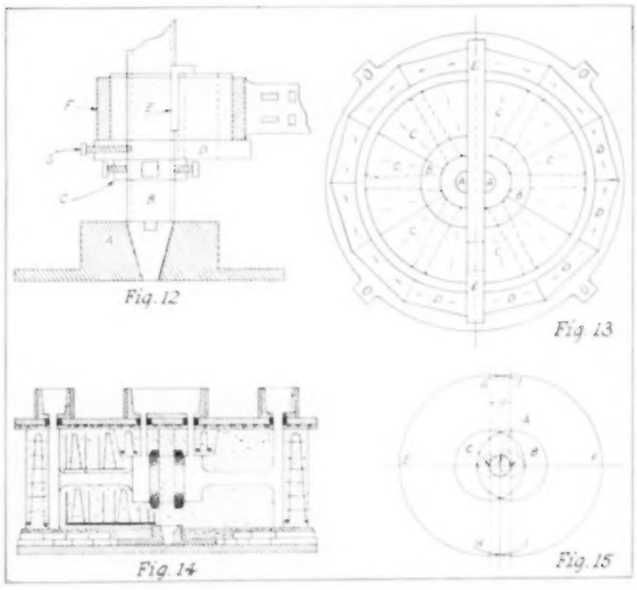


Fig. 12—Detail of socket, spindle, collar, eccentric block and sweep arm. Fig. 13—Assembled wheel mold partly swept and partly formed in dry sand cores. Fig. 14—Cross sectional view of flywheel mold showing cores, gates and risers. Fig. 15—Composite view of the two positions assumed by the eccentric block in forming a split wheel mold

A straight-edge with a gap to embrace half the spindle diameter is laid first in line with the two sockets and a line is drawn on the sand from one side of the mold to the other. This line is shown at *E F* Fig. 15. This figure represents the second method where an eccentric block is employed, but the method of drawing the center lines is the same in both methods.

Draw Lines for Splitting Cores

By placing one edge of a square against this line the molder can adjust his straight-edge at right angles and draw the lines *G H* and *I J* at right angles to the line *E F* and through the centers of each socket or spindle. These lines *G H* and *I J* mark the space to be occupied first by the splitting core prints and later by the splitting cores. The coreprint, a loose piece of pattern, is laid up against the main pattern segment and rammed right in place in the sand. After the pattern has completed the first half circle, the second coreprint is located and rammed in place in a similar manner. Pattern segment and spindle then are shifted to the opposite half of the circle and the process is repeated with the exception that the core prints receive no further attention.

Where no pattern segment is available the mold cavity may be swept out as shown in the upper part of Fig. 2. The drag first is rammed full of sand. Then a trench roughly approximating the shape of the casting is dug. The trench is lined with facing sand and then the sweep is revolved inside to impart the desired shape.

Several methods are available for forming the cope of the mold. In (*Please turn to page* 56)

Casts Bronze Chains in Core Molds

Required number of single links are cast in advance and placed in cores

MANY years ago an enterprising young man engaged in the brass foundry industry visited a sheet steel mill with the laudable intention of soliciting orders for some of his various products. The man whom he contacted—a revolting modern term happily unknown in the good old days—happened to be in a peevish mood that morning. Certain pieces of equipment had failed at a crucial moment, to wit, while lifting sheets out of a pickling bath. The mill man was quite hostile toward the world in general and called upon high heaven to witness that he had no time to talk about brass castings. The immediate need of the moment was to retire into his den where he could compose a letter that would lift the hide in long quivering strips from people who supplied rigging that lasted just about as long as a beeswax cat would last in what he devoutly hoped would be the aforesaid peoples' ultimate destination.

The brass foundryman concurred heartily in this noble sentiment, particularly since it had furnished him with an inspiration.

"What you need," said he, "is a heavy, substantial bronze chain, pickle proof to the last drop."

"A bronze chain?" quoth the mill man. "There ain't no such animal. 'Twould probably fill the bill, but where in the name of Peter, patron saint of all the pickled peppers can I get a chain of that kind?"

"Nothing to it," the brass man intimated modestly, "I'll make you one."

"Good bye," said the mill man, "I won't be seeing *you* for some time!"

On the homeward journey the foundryman felt that perhaps he had been a little precipitate. The salesman's urge, coupled with a natural confidence based on the solution of many peculiar foundry problems had prompted him to a promise which he now was inclined to regret. He never had seen a cast chain made in the foundry. He had seen references to cast chains, but none of these references had hinted even remotely at the foundry methods involved. However, with the natural optimism of youth he reflected that what had been done before could be done again and perhaps done better.

Forty times, more or less, he thought he had the solution only to be brought up standing by some form of impediment. Suddenly in his mental groping he stumbled over the key to the puzzle. He tested the problem from every conceivable mental angle and was highly gratified to find that the answer worked out as easily and infallible as adding two and two to make four.

Robert C. Hopkins, president, Alliance Brass & Bronze Co., Alliance, O., instructed his patternmaker how to make the required patterns and corebox for a heavy bronze chain which later was delivered to the mill man. Since that far away day thousands of feet of chain have been made according to the same method to the mutual satisfaction of maker and customer. The method is simple and lends itself readily to

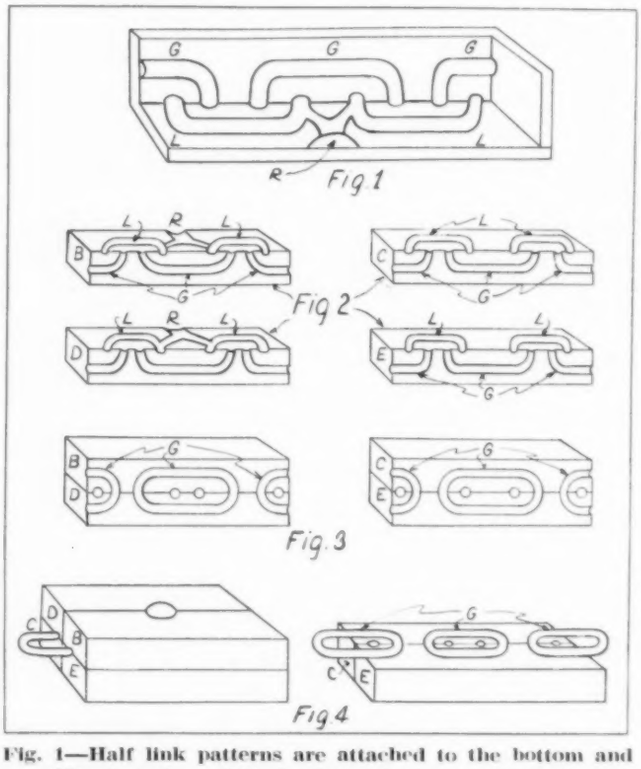


Fig. 1—Half link patterns are attached to the bottom and one side of corebox. Fig. 2—Set of four cores for each unit. Fig. 3—Core sections assembled in pairs. Fig. 4 (Right)—Precast links in position. (Left)—Assembled core unit

the production of chains in all sizes lengths and variety of link shapes, insertion at any point of special links, hooks, swivels, or repair parts.

With minor adaptations to meet production schedules in the steel foundry of a navy yard, the method was described in the June 1, 1930 issue of THE FOUNDRY. Here the cores were provided with special runners and risers, were made in metal coreboxes on a jolt machine and arranged in stacked formation to facilitate pouring a large number of links from each runner.

In the Alliance foundry where the job only appears intermittently, one of a wide variety of miscellaneous jobbing castings, the sand is rammed by hand in a wood corebox, no risers are needed on the castings and the units are arranged in any desired length to be poured two links at a time through a single runner. The design of the corebox, R. C. Hopkins' original conception, is the same in both instances.

Process Involves Two Main Operations

Construction of any given chain involves two operations. In the first a predetermined number of single links are cast in the usual manner. That is the required number of link patterns to fill a flask are mounted either as whole links on a follow board, or as split patterns on a flat board or matchplate. The resulting castings are cleaned and placed in suitable depressions in the chain cores as shown in Fig. 5. These cores are placed end to end for any given distance with the cast links lying horizontal and the cavities for the new or connecting links in a vertical position. A runner in the upper or cope section of the core conducts the metal to two of these links and the result is a unit of five links. The process is repeated until a sufficient number of links have been joined to form the required length of chain.

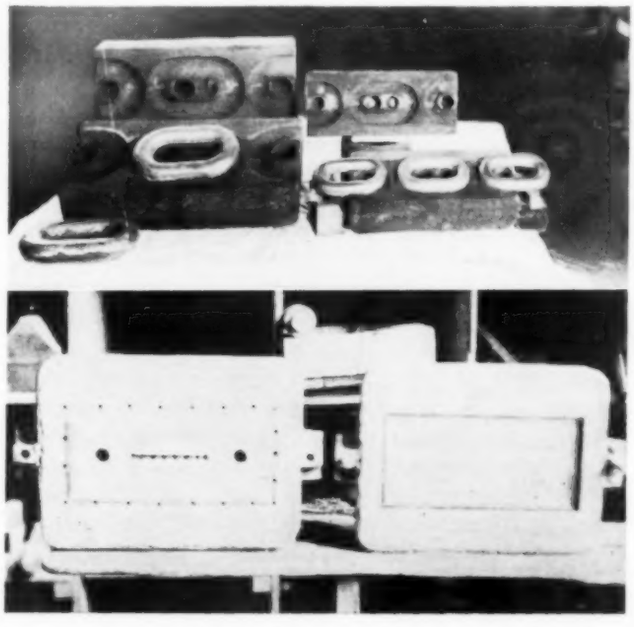


Fig. 5 (Above)—Dry sand cores serve as cope and drag. Three horizontal precast links are united by pouring metal into two vertical link cavities. Fig. 6 (Below)—Metal enters tablet mold through a row of pencil gates near the center

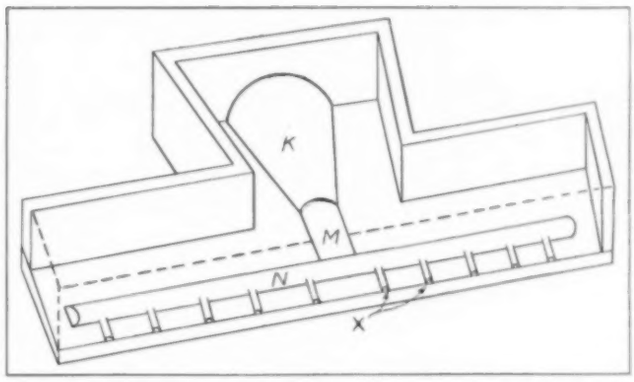


Fig. 7—Showing general features of typical corebox for making tablet gate cores. Two half cores are pasted face to face to form the complete core

A free hand sketch of the corebox, not drawn to scale, and with one end and one side removed to show the interior, is presented in Fig. 1. A graphic presentation of the various steps in assembling the cores for each mold unit is shown in Figs. 2, 3 and 4.

Each mold unit is made up of four duplicate cores with the single exception that the runner and gates are omitted from two. Thus it will be noted that this item is present in cores *B* and *D* Fig. 2 and missing in cores *C* and *E*. The piece of pattern equipment *R* Fig. 1 required for this feature is loose in the box and may be removed at will. A predetermined number of core parts are formed with the part in place. Then it is removed and a corresponding number of cores are made without it.

Gives Alternative Method

Two half link patterns *L L* are mounted on the bottom face of the corebox. These form the mold cavity for the molten bronze. One half link and two quarter link patterns *G* are attached to one of the side walls of the corebox. They form the seats for the pre-cast links. They are held in place temporarily by nails which are removed after the corebox has been rolled over on a plate. The core box then can be removed from the core. The half link and the two quarter links are removed from the side of the core and replaced in the box in preparation for the next core. An alternative method as practiced in the steel foundry referred to previously, is to attach the link parts *G* permanently to the side of the box. After the corebox is rolled over, the side of the box is drawn back a sufficient distance to clear the core.

The various link part patterns are mounted symmetrically in the corebox in relation to center lines and as a result a core may be used either as a right or a left. When the four cores finally are assembled in their proper relative position to form a mold unit, the various cavities coincide to form openings of the required contour. The horizontal (*Please turn to page* 59)

Questions and Answers

Covering important problems found in all phases of modern foundry practice

This department includes problems relating to metallurgical, melting and molding practice encountered in making castings. Questions from subscribers addressed to the Editor of The Foundry will be answered by members of the editorial staff, supplemented where occasion requires by the advisory staff.

White Iron Balls for Grinding Cast in Iron Molds

We shall appreciate any information you can give us on a machine which we understand is employed in some places for the manufacture of white iron balls for grinding purposes. We have made quite a quantity of these castings in the ordinary manner from matchplates in green sand molds, but the method is expensive. The limited market in our district will not warrant the installation of an elaborate machine.

White iron balls for grinding various materials are cast according to two different methods. The method adopted depends to some extent on the diameter of the ball and to a greater extent on the volume of business. Up to 1-inch in diameter all the castings are poured in sand molds. Perhaps a permanent mold eventually will be developed to produce small size balls, but up to the present—so far as we know—none is in use. In several instances they have been tried and discarded.

On sizes over 1-inch and up to 6 inches, many foundrymen still prefer the sand molds. This is particularly true where the production is intermittent and where the quantity ordered at any one time is not burdensome. Where the business is steady and where the production is large, several firms have found it profitable to install cast iron molds.

In at least two large installations in this country the split molds are mounted in two batteries. While the operators are pouring the metal into one battery, other operators remove the castings from the second battery and reassemble the molds. One half of each vertical mold is stationary, while the second half is mounted on a sliding base and is pushed into and out of contact with the first half by a hydraulically driven arm. One of these installations was described at considerable length in the April 15, 1926, issue of THE FOUNDRY, pages 308 to 310.

In another place the iron blocks are provided with mold cavities on both sides and are assembled in long groups. In other words the molds are stacked horizontally instead of vertically. These molds are provided with brackets or wings on the sides which slide on V-guides. They are comparativeliy light and may be manipulated by hand. The entire battery is assembled inside a substantial frame, and the various sections are jammed together by a heavy coil spring inside one end of the frame.

Sponginess May Be Due To Metal Melted Improperly

We are interested in a soft, easily machined metal that will cast clean so that it can be chromium plated. We have used 85-5-5-5 metal and various brass mixtures, but we experience a certain amount of sponginess seemingly due to dross. Possibly the type of bronze used in making mold castings would be suitable.

While it is difficult to diagnose your difficulty without seeing the castings, it appears that the sponginess arises from some other cause than the mixture employed. Smooth castings are obtained with 85-5-5-5 alloy. As far as we know, no special mixture is employed in making bronze molds for slush-casting.

We wonder if the sponginess you mention may better be designated as pinholing. In such cases the minute holes become filled with polishing and buffing compounds giving the appearance of small black specks on the surface. If that describes the appearance, we believe that your metal is not being melted properly and that a reducing atmosphere is present. The metal absorbs gas which is thrown out as the metal solidifies. The ejection of the gas forms minute holes at or near the surface.

Again the sponginess may be due to improper feeding of the casting particularly if it has thick and thin sections adjoining, and the thick sections now are fed through the thin ones. If that is the case, the gating should be changed to enter

the heavy section, or if that is not practicable, risers must be placed over the heavy sections to feed them properly.

Several Mixtures Available For Use in Plumbers Fittings

Can you give us a good cheap yellow metal alloy which may be used for gascocks or similar parts?

One of the cheapest mixtures used for making gascocks is that composed of 66 per cent copper; 31 per cent zinc; and 3 per cent lead. A little more expensive alloy, which is harder, contains 66 per cent copper; 30 per cent zinc; 2 per cent tin, and 2 per cent lead. The American Society for Testing Materials tentative standard B30-32T recommends an alloy containing from 70 to 71 per cent copper; 1 to 2 per cent tin; 2 to 4 per cent lead, and 20 to 24 per cent zinc for plumbers fittings. That material is not difficult to handle in the foundry, machines easily, and has a fairly high strength. As far as we know both body and keys are made of the same metal.

Excessive Time Required For Melting Bronze for Tablet

We are mailing a section of a defective bronze tablet, and would like to know what caused the defect. The mixture is supposed to consist of copper 90 per cent, tin 9 per cent and zinc 1 per cent. The crucible was put in the furnace at 2:30 and taken out at 4:45 at a temperature of 2225 degrees, and the metal was poured as soon as skimmed. Eight ounces of 15 per cent phosphor copper was used as a flux, half of which was placed in the bottom of the crucible and the remainder on top of the ingot. After shaking out, the casting appeared to be perfect and the holes did not show up until after sandblasting.

The sample indicates the metal possibly was in the fire an excessively long time. You do not state how many pounds of metal were charged so that the time you indicate as required for melting cannot be gaged since, of course, the larger the charge, the more time it would take to reach the pouring temperature. However, we assume that your charge was about 100 pounds.

Melt of 100 pounds should not require more than 1½ hours. Possibly the furnace you use has an inadequate supply of oxygen. If it is a coke fired furnace using a natural draft, the flues may be choked, or the stack may not be sufficiently tight to give you an ample supply of oxygen. If it is an oil furnace, an investigation of the burner may show that the air supply is hampered by some foreign material, or that the piping is such as to offer a high resistance for the flow of air and thus prevent combustion of the oil.

The longer a bath of metal is in the furnace, the greater the time available for absorption of gases. The gases are liberated from the metal as it solidifies causing worm holes visible in the sample casting.

The rest of the practice seems good, in fact the entire practice probably has been satisfactory and the trouble only arises now because of some reduction in the flow of the necessary air or oxygen for complete combustion. The hotter the furnace, consequently the faster the melting and less trouble encountered.

You ask about how to recover this metal for future use in making tablets. Pouring off the metal that has been gased into ingot molds and remelting it in a furnace that is sufficiently fast, would eliminate the gas problem and the metal thus remelted will be found to be satisfactory.

Alloy Hard To Handle Unless Deoxidized Properly

We are making a pressure metal analyzing 85 per cent copper, 10 per cent tin and 5 per cent lead. We experience difficulties with castings leaking, and would appreciate any information you can give on the subject.

We would like to know what pressure is required for the castings you have in mind and for what service these castings are used. The alloy 85 per cent copper, 10 per cent tin, 5 per cent lead is not simple to handle in the foundry, unless it is deoxidized properly with some good deoxidizing agent, such as phosphorus, or in some instances a small amount of zinc. For certain purposes, zinc is not desirable and phosphorus is to be preferred, whereas in other instances zinc is to be preferred.

With 10 per cent tin, this alloy becomes relatively expensive. In many classes of work, such a high tin content is not necessary and, therefore, adds to the cost without being beneficial. It also increases the machining difficulties, because it makes a harder material than many types of service require.

The Electrical building at the Chicago Century of Progress provides a wide variety of interesting and instructive displays for the visitor

Best Grade of Shellac Should Be Used

What do you consider the best grade of shellac to use on chills to be air dried for nonferrous castings. Lately we have experienced trouble from blowing and the shellac does not seem to air dry thoroughly.

Good quality shellac should dry in 30 minutes to a condition so that it may be sanded, poor shellac may remain tacky for hours and longer. Usually in the latter instance, the shellac, instead of being pure gum, is adulterated with rosin, manila gum, etc. Hence, it is advisable if you are purchasing gum shellac and mixing it yourself, to obtain only pure gum shellac from reputable sources. It is more expensive naturally, than inferior grades, but it is cheaper in the end. If you purchase ready mixed shellac, buy it from a reputable source, and if you have trouble with it remaining tacky, take it up with the firm from which it was obtained.

While on the subject, it may be well to inquire into the condition of the chills employed in your work. Sound castings only can be obtained when the chills are perfectly clean, no matter what the coating is. That means that they should be sandblasted or otherwise cleaned to insure freedom from rust, grease, dirt, etc. Also, when chills are used, they should not be placed in the mold for any great length of time previous to pouring as moisture from the sand tends to condense upon them, and results in blows. Where possible, the chills should be warmed, placed in the mold, the mold closed and poured.

Forces Materials Into Pores of Casting

We manufacture a gray iron steam chamber and on this casting we occasionally develop porosity at various points so that in testing we find leakers. We understand that there is some chemical or compound that can be used on the inside portion of these steam chambers which will fill the porous sections and make the casting fit for service.

There are two possible methods of doctoring your steam chest castings to eliminate leakage. One is to force a solution of salammoniac (ammonium chloride) under pressure into the casting so that it seeps through the porous sections. Then the solution is removed and the casting exposed to the action of the atmosphere for a day or two. Sometimes two or three applications of the solution are necessary, but of course, it will only work when the trouble encountered is seepage or sweating rather than a leak. The salammoniac reacts with the iron to form iron ammonium hydroxide which under the action of the air changes to iron hydroxide. That fills the pores, and hardens in place.

A liquid synthetic resin compound has been developed and is on the market which is used similarly to the previous method, and is said to eliminate leakage.

While those methods may overcome your trouble, it appears to us that a careful check up on your methods of gating and risering the casting will eliminate the difficulty. Also it is possible that by changing your mixture you might be able to get sound castings without changing the gates, etc.

Suggests Apatite To Raise Phosphorus

We would appreciate information on the use of phosphate rock in the cupola to raise the phosphorus content of the iron.

As far as we know phosphate rock or apatite is employed to some extent only in blast furnace practice where low phosphorus ores are the available material, and it is desired to maintain phosphorus in the pig above 0.50 per cent. There seems to be no reason why it could not be employed in the cupola to increase the phosphorus content of the resulting metal, except the possibility of difficulty in obtaining a uniform content from day to day. Apatite or phosphate rock is composed of calcium phosphate and calcium fluoride, the chemical formula being $3\,Ca_3(PO_4)_2$. CaF_2 when pure, and containing slightly over 3 per cent phosphorus. If the phosphate rock is straight calcic phosphate the formula would be $Ca_3(PO_4)_2$ when pure, and the phosphorus content would be 2 per cent.

According to blast furnace theory, when using ordinary slags all of the phosphorus goes into the iron. However, if a scouring slag is present phosphorus is removed. Consequently, it seems reasonable to assume that if apatite or phosphate rock is introduced into the cupola, its phosphorus will enter the iron. A certain amount of experimental work should be performed to determine the proper procedure as phosphate rock contains considerable calcium which will have to be fluxed by silicon. That will necessitate the addition of silica in the form of sand or quartz, otherwise the lining will be corroded badly. Of course, there is a certain amount of silica, iron oxide, etc., carried in with the iron charge in the cupola, or formed during the melting process which usually is removed through addition of limestone to form the requisite slag. Consequently, that phase would have to be investigated so that neither too much lime or too much silica will be present.

Theoretically, pure apatite of the formula previously given, contains 39.68 per cent calcium, while pure limestone contains 40 per cent calcium, so that it appears that every pound of apatite added to the cupola should require a corresponding reduction of the amount of limestone. As for determining the amount of apatite required, it has been mentioned that the rock contains 3 per cent phosphorus so that one pound of rock contains 0.03-pound of phosphorus. Therefore, if it is desired to increase the phosphorus content of 1000 pounds of iron 0.10 per cent, 33.3 pounds of apatite would be required, and the limestone usually added to the charge would have to be reduced by a like amount.

Ordinarily, only about 30 pounds of limestone is added per 1000 pounds of iron, so that excess silica in the form of sand would have to be added to take care of the excess lime. Theoretically, 1 pound of calcium requires 1.5 pounds of silica (SiO_2) for fluxing, and in the case mentioned there will be an excess of 1.2 pounds of calcium so that 1.8 pounds of silica will have to be added with the apatite. That makes an addition of 33.3 pounds of apatite, 1.8 pounds of sand (silica), and no limestone to 1000 pounds of iron to increase the phosphorus 0.10 per cent.

Surface Defects Caused by Parting Dust

Under separate cover we are forwarding four small malleable iron castings in which the surface is pitted. We shall appreciate your opinion on the cause of, and the remedy for this condition. The iron is melted in an air furnace fired with pulverized coal and the molds are made in No. 1 Albany sand.

From the character of the defect in the castings one would be inclined to the opinion that the molds were made in a sand heavily impregnated with clay, but since No. 1 Albany sand does not fall in this category, it is apparent that some other factor is responsible for the trouble. Without an actual examination, or further data it is impossible to express a positive opinion, but the most probable cause of the defect is the parting compound.

Certain materials used for parting are perfectly satisfactory when used for the purpose for which they are intended, but they are not at all satisfactory when employed as a facing. Your molders probably are using this material to dust the patterns before filling the flask with sand. Some of the parting materials are harmless when used in this manner, but others *wash* before the stream of iron and in addition cause a slight boiling action in the iron which lies against the face of the mold.

Viewing Foundry Developments

At Short Range

SEVERAL practical suggestions regarding the casting of magnesium alloys have been made by a large aeronautical company as follows: As a rule castings should be gated as near the bottom as possible; pouring temperature should be as low as practicable; chills should be made from graphite or cast magnesium. Experience has shown that foundry scrap is considerably higher for magnesium than aluminum, but defectives found in machine shops are about equal for the two metals.

♦ ♦ ♦

To obtain extremely hard studs for wear resisting purposes on cast iron road plates that it makes, a British firm coats the iron chills used in their production with sulphur or sulphur compounds by spraying. Parts of the chill where increased hardness is not desired are covered with a templet.

♦ ♦ ♦

PROTECTION of light metals such as aluminum alloys and magnesium alloys against corrosion is secured by immersing them in boiling solutions containing fluorides for 15 to 20 minutes according to a recent patent. One solution suggested contains 10 grams fluovanadate of potassium, 1 gram of fluosilicate of sodium, 1 gram of double tartrate of sodium and potassium and 1000 cubic centimeters of water. Another solution contains 2 grams of double fluoride of sodium and potassium, 1 gram of chromium fluoride, 0.5 gram of sodium fluoride, and 1000 cubic centimeters of water. After treatment the surfaces are coated with wax, oil, or grease.

♦ ♦ ♦

A phenolic condensation product is available for binding cores. Features claimed include: One half to one third saving in baking time, nothing but water vapor given off during drying, baked core does not absorb moisture readily and retains good definition, the material is miscible in water so that core boxes may be cleaned with water, cores compress readily upon contraction of the metal.

♦ ♦ ♦

An automotive cam shaft made from cast metal containing the following alloys showed a fine structure. Nickel 0.40 to 0.50 per cent; chromium 0.80 to 1.0 per cent; molybdenum 0.40 to 0.50 per cent. The iron had a high resistance to impact and torsion, as well as wear.

♦ ♦ ♦

THE analysis of a metal recommended for cast iron dies to be used for medium duty work and relatively deep drawings is as follows: Total carbon 2.75 to 3.00 per cent; manganese 0.60 to 0.90 per cent; phosphorus under 0.30 per cent; sulphur under 0.12 per cent; silicon 1.25 to 1.50 per cent; nickel 1.50 to 2.00 per cent; chromium 0.25 to 0.50 per cent. The metal has a tensile strength greater than 50,000 pounds per square inch and can be used in either the cast or the heat treated condition.

♦ ♦ ♦

A line of coatings and dressings for dies and molds for nonferrous metals recently has been introduced. These materials are said to act as an insulator as well as a lubricator, and to give the castings a smooth appearance and a good finish. They are applied to the surface of the hot dies or molds with air under pressure, thus filling the pores and fine cracks. One application is claimed to last for 300 shots in the die casting machine.

♦ ♦ ♦

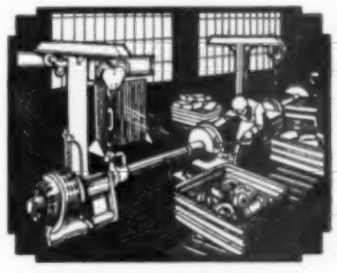
For many years British foundrymen have found the manufacture of rainwater goods, consisting of gutters, spouts, elbows, tees, etc., a satisfactory business and now an effort is being made to effect a standardization of sizes to reduce the cost of manufacture and provide a greater profit. Perhaps American foundrymen are overlooking a good market for castings in not exploiting this field, since cast iron and nonferrous castings both possess corrosion resisting properties greatly in excess of sheet metal products now in use.

♦ ♦ ♦

PHYSICAL properties of high chromium steel castings used under hydraulic pressure are improved by incorporating small percentages of nitrogen into the molten metal, it is claimed. Nitrogen refines the grain. The percentage in the finished casting is small, less than 0.4 per cent being sufficient, and this amount is added readily by ferrochrome that has been prepared specially, with a definite content of nitrogen. These castings of denser metal are finding use in the oil refining industry where conditions of heat and corrosion are so severe.

♦ ♦ ♦

A patented process for making permanent or semipermanent molds includes the use of silicon carbide and zirconium silicate. The zirconium silicate is mixed with silica or sand, and sodium silicate. With



silicon carbide a solution first is made of sodium silicate of the ratio 1:3.5 to a concentration of 20 per cent solids. Then 150 grams of that is mixed with 1100 grams of silicon carbide of 100 mesh or finer. The moist material is used like molding sand. Mold is air dried for 24 hours and baked at 500 to 550 degrees Fahr. before use.

The FOUNDRY Family Photograph Album

Harris & Ewing

Upper Left

R. G. SWEENEY
Allyne-Ryan Foundry Co.
Cleveland

Upper Right

M. L. ENGER
University of Illinois
Urbana, Ill.

Lower Left

C. E. ADAMS
Air Reduction Co.
New York

Lower Right

A. W. WRIEDEN
Warm Air Furnace Mfrs. Institute
Holland, Mich.

Men of Industry

Whose Activities Are Making Foundry History

JAMES H. LANSING recently was appointed general manager of the Grand Rapids Malleable Works, Grand Rapids, Mich., a subsidiary of the Chicago Railway Equipment Co., Chicago. After graduating from Williams college, Mr. Lansing entered the military service serving both in this country and in France. He then became connected with the Eastern Malleable Iron Co., Troy, N. Y., gaining first-hand knowl-

James H. Lansing

edge of foundry operations. After 2 years at that plant, he spent several months in the laboratory of Dr. Enrique Touceda, studying metallurgy, and during the two succeeding years supervised all the metallurgical work at the Wilmington Malleable Iron Works, Wilmington, Del.

From 1923 to 1926, Mr. Lansing was employed as metallurgist at the Lakeside Malleable Castings Co., Milwaukee He resigned that position to become field assistant to the consulting engineer of the Malleable Iron Research Institute. After a year in that capacity, he accepted a position as general superintendent and works manager of the Danville Malleable Iron Co., Danville, Ill. where he remained for 7 years. During the past year he held a similar position with the Decatur Malleable Iron Co., Decatur, Ill.

Mr. Lansing has been active in the American Foundrymen's association and the Malleable Iron Research institute and has presented papers before various technical societies. He is chairman of the malleable division of the A. F. A.

❖ ❖ ❖

EDWARD H. MUEHLENBROCK has been elected president of the Holland Furnace Co., Holland, Mich., succeeding H. W. THORNE, recently resigned.

❖ ❖ ❖

PAUL A. IVY, vice president, National Cast Iron Pipe Co., Birmingham, Ala., recently was elected a member of the board of directors of the Birmingham chamber of commerce.

❖ ❖ ❖

V. S. VEENMAN, formerly connected with the Nolte Brass Foundry Co., Springfield, Ohio, now is superintendent of the Akron Bronze & Aluminum Co., Akron, O., manufacturers of jobbing bronze and copper castings.

❖ ❖ ❖

BURTON W. SPENCER, for 40 years connected with the foundry of the Bradley & Hubbard Mfg. Co., Meriden, Conn., and for 30 years foundry superintendent of that firm, has resigned to become associated with the Connecticut Foundry Co., Rocky Hill, Conn.

❖ ❖ ❖

CLYDE H. BURGSTON, recently elected president of the Quad-City Foundrymen's association, is metallurgist in the testing and research laboratories of Deere & Co., Moline, Ill. Mr. Burgston was graduated from the University of Illinois, Urbana, Ill., in 1917 and then served in the army as lieutenant of field artillery until February, 1919. A month later he entered the employ of Deere & Co., agricultural implement manufacturers, as metallurgist. He was transferred to the Union Malleable Iron Co. of Deere & Co. in 1926 and served as superintendent of the plant until 1930. Since that time he has been connected with Deere & Co. as metallurgist in the testing and research laboratories, where a considerable portion of his time has been spent on malleable and cast iron foundry problems. Recently he has been engaged in the development of specifications, standardization and in a study of welding as applied to the fabrication of implement parts. He is a past presi-

Clyde H. Burgston

dent of the Tri-City Chemists club and the Tri-City chapter of the A. S. M.

❖ ❖ ❖

E. W. SCHUMACHER, president of the recently organized Schumacher-Kelly Co. Inc., Freehold, N. J., previously was connected with the C. S. Bell Co., Hillsboro, O., for 30 years, serving as secretary and treasurer of the firm. Michael J. Kelly, vice president of the new company at one time was connected with the W. W. Woodruff & Sons Co., Hartford, Conn., the Sacks-Barlow Foundry, Newark, N. J., and recently was superintendent of the Hope Foundry & Machine Co., Maplewood, N. J.

Reader's Comment

Interesting communications from readers of The Foundry

EDITOR'S NOTE — *Material Appearing Under this Head Does Not Necessarily Reflect the Opinion of* THE FOUNDRY *or of Its Editors.*

Blames Core Sand

TO THE EDITOR:

In a recent question and answer in THE FOUNDRY the opinion was expresse that small pin holes in the cope surface of a brass castings were caused by loose sand in the mold. This sand or dirt may result from not cleaning out the mold properly, slight cutting at the gate, or from a dry crumbly condition of the sand particularly at the joint edges.

Is it not possible that the trouble is due to dumping the molds containing cores so that part of the core sand becomes incorporated in the molding sand? We have had trouble from this practice and I consider that this is a point well worth watching.

JAMES FRASER

Speakman Co.,
Wilmington, Del.

In South Africa

TO THE EDITORS:

You will be pleased to learn that THE FOUNDRY is a welcome visitor in this part of the world so far from its home. I can assure you by the few who get it that it is one of the best journals published dealing with foundry work and one which we all eagerly wait for every month.

JAMES S. BARCLAY

201 *Goble Road,*
Durban, South Africa.

Poor Practice

TO THE EDITORS:

One of the principle hardships met by the manufacturers of foundry equipment is the tendency of foundrymen to overload their equipment. Speaking generally, this practice increases repair bills, shortens life, and occasionally results in disastrous breakdowns.

On page 29 of the July 15 issue of THE FOUNDRY, mention is made of a foundry lifting approximately 60 tons with a 30-ton crane. The incident is a real tribute to the maker of the crane, but such practices, if generally indulged in with foundry equipment, would be most unfortunate. Makers of foundry equipment must necessarily contend with sand abrasive conditions and almost universal lack of proper maintenance and lubrication service. Overloading is all too prevalent and it is hoped that no reader will gain from your article the impression that, even under stress of exceptional circumstances, 100 per cent overloads are good practice or safe practice.

JOHN D. WISE,
Executive Secretary
Foundry Equipment Manufacturers Association

Code Authority Approved by NRA

The code authority of the conveyor and material preparation equipment manufacturing industry recently was approved by National Recovery Administrator Hugh S. Johnson. The personnel of the code authority is as follows: George P. Torrence, Link Belt Co., Chicago; H. L. Donahower, Standard Conveyor Co., St. Paul, Minn.; D. B. Pierson, Stephens-Adamson Mfg. Co., Aurora, Ill.; F. C. Morrow, Morrow Mfg. Co., Wellston, O.; W. S. Lister, C. O. Bartlett & Snow Co., Cleveland; and W. B. Greene, Barber Greene Co., Aurora, Ill.

Obtaining Dark Color on Bronze Casting

To obtain a dark color on bronze fixtures, it first is necessary to clean the castings thoroughly by scouring with a solution of one pound each of slacked lime and pumice in 1 gallon of water. The water is heated to 120 degrees Fahr., and then 4 ounces of sodium cyanide is added. The latter is extremely poisonous, and care should be exercised in its use. Wear rubber gloves to keep it off the hands. The castings are scoured using a tampico brush. After they are clean, flush them with plenty of water from a hose. Immerse the castings in boiling hot water, and then allow them to drain.

Have a previously prepared solution composed of 1 gallon of water to which 4 ounces of sodium or potassium polysulphide, and 2 ounces of ammonia (26 degrees Beaume) are added. The water should be heated to 120 degrees Fahr. before adding the other materials. Apply the solution to the castings with a brush or by dipping until the desired color is obtained. Wash with cold water, and then immerse in hot water. Allow the castings to drain. Usually if the water is hot enough, they will dry rapidly. If the color is too dark, scratch brushing will lighten it up. The castings should be lacquered to protect the surface.

Copper Additions To Malleable Cast Iron

Dr. C. H. Lorig, Battelle Memorial institute speaking at a recent foundry conference gave in detail some interesting facts on the effect of copper in malleable iron. Copper, soluble up to 3 per cent in the furnace and 1 per cent in the ladle, imparts properties similar to nickel additions in that it accelerates gravitization. It is necessary to adjust silicon in relation to copper and with every increase of 1 per cent in copper it is necessary to reduce silicon 0.1 per cent.

A series of tests were made on malleable iron of the following analysis: Carbon, 2.4; silicon, 1.01; manganese, 0.31; phosphorus, 0.14; sulphur, 1.075 per cent. Additions of copper were made successively ranging as follows: 0; 1.33; 1.73; 2.94, per cent.

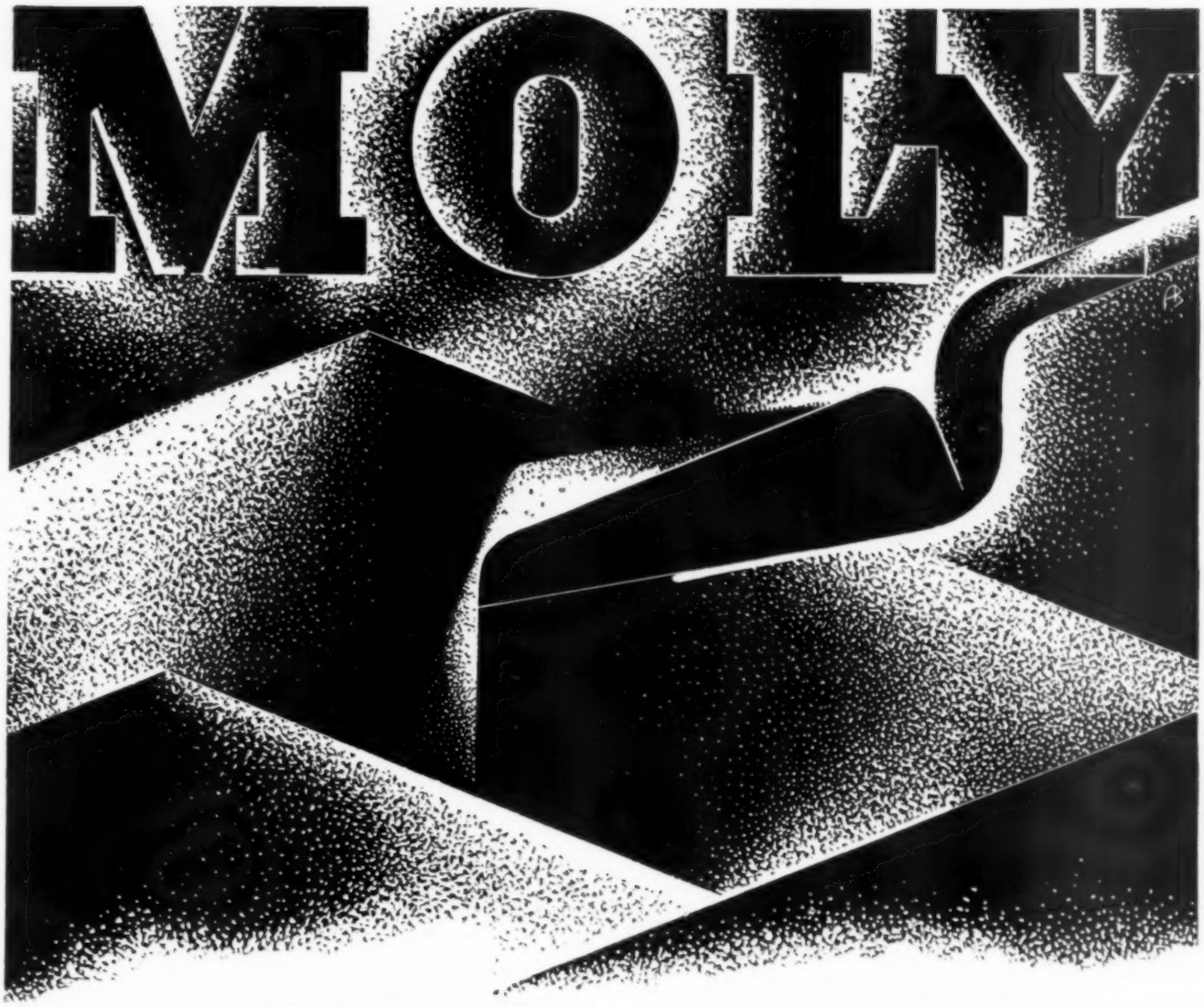
A marked reduction in the annealing time at full temperature resulted, although it was not possible to shorten the time of cooling down. The rate of cooling was maintained at about 20 degrees Fahr. per hour as compared with 14 degrees Fahr. per hour in the material having no copper.

The effect on physical properties in relation to the copper additions was as follows:

Copper Content Per cent	Tensile Strength	Yield Point	Elongation Per cent
0	56,000	36,000	14.0
1.33	64,000	49,000	12.0
1.73	63,000	47,000	11.2
2.9	63,000	47,000	9.5

Embrittlement below the critical range is lessened by the addition of copper, a factor of value in producing galvanized malleable castings. Copper also decreases corrosion.

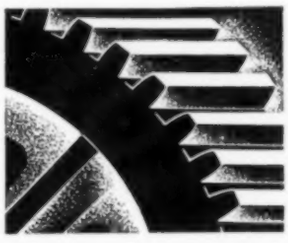
An investigation is being made of precipitation hardening by a treatment involving heating and drawing to permit some of the copper absorbed in the iron to precipitate out. This treatment increases tensile strength and yield point, decreases elongation, and increases hardness from about 120 brinell to 150.



LIKE CEMENT IN SAND . . . A LITTLE DOES A LOT

ONE of the great advantages of the use of Molybdenum is in the fact that a small amount of this versatile alloy does a great deal of work.

In cast iron, for instance: An interesting example is that of a 3000-pound cast-iron gear, the teeth of which had to be hobbed from the original casting. Previous to the application of "Moly," a total of 84 pounds of alloy had to be added to the iron to produce a suitable mix for this purpose. By using Molybdenum, the total alloy addition was dropped to 27 pounds, the alloy cost reduced considerably and the resultant product had a better finish, greater strength, toughness and wear resistance.



In *any* iron, or steel, "Moly" can be depended on to enhance the desirable qualities. Easier machinability, without loss of hardness or toughness, stronger welds, greater corrosion resistance may be added to those already mentioned. And invariably the improvement is worth far more than the cost of the small quantity of Molybdenum required.

"*The Moly Matrix*" is a new house organ designed to help executives and engineers to keep up to date with the new developments in Molybdenum metals. A post-card request will put you on our mailing list. And our metallurgists and modern laboratory facilities in Detroit are ever available to aid in your alloy experiments or problems. Write also for these interesting new books: "*Molybdenum in* 1934" and "*Molybdenum in Cast Iron*—1934 *Supplement.*"

CLIMAX MOLYBDENUM COMPANY, 295 MADISON AVENUE, NEW YORK

CLIMAX Mo-lyb-den-um

Prevent Losses with

Proper Gates and Risers

BY PAT DWYER

FOUNDRYMEN generally are familiar with the use of skim gates for molds on gray iron castings. As is well known, the object of a skim gate is to prevent dirt, slag, sand or other foreign material from entering the mold with the stream of metal. The skimming device in the gate or runner passage may be a perforated metal plate which resists the flow of metal until a reservoir has been built up in the pouring basin. This is the simplest of all forms and is based on the fact that foreign inclusions are lighter than the metal and therefore will float to the top of the metal in the reservoir. The clean metal flows into the runner from the bottom of the reservoir. So long as the basin is kept filled this condition will continue. The same general principle is employed in all forms of skimmer gates where the metal is manipulated in the passage in a manner that permits the foreign material to float to the top. This feature was covered extensively in previous articles in the present series dealing specifically with iron foundry practice.

Early Prejudice Remains

The practice although prevalent in gray iron foundries has not been adopted to any extent in the foundries devoted to the production of steel castings. This is due in part to early prejudice. Steel does not flow as freely as iron and since all the early steel molders were converted iron molders they noticed this peculiarity and provided large, generous gates without impediment of any kind to the free entrance of the metal. Consciously, or subconsciously lingering traces of this early prejudice still remains and many foundrymen are reluctant in trying any device that temporarily might halt or impede the stream of steel in its passage from the ladle to the mold cavity.

Also, up to a comparatively few years ago all steel was poured through the bottom of the ladle and therefore, save in exceptional instances, was free from slag or other inclusions. Bottom pour ladles still are employed exclusively for pouring large castings, and are used extensively in many foundries devoted to the production of comparatively light castings. However, a constantly increasing tonnage of steel is poured over the lip of crane and shank ladles and several steel foundrymen have realized the advantage of borrowing a leaf or two from the iron foundryman's book of skim gates.

To a limited extent with the recently introduced type of induction furnace some small special alloy steel castings are poured directly from the furnace spout, but by far the preponderating volume of steel still is poured according to one of three methods, over the lip as in iron or nonferrous practice, through a teapot spout, or through a nozzle in the bottom of the ladle.

In the first method the slag, more or less successfully is prevented from entering the mold by a skimmer in the hands of an attendant. Manifestly the success of this method is problematical, depending as it does on the skill and alertness of the operator. Even under the most favorable conditions some of the liquid slag will flow in with the metal. In some instances attempt is made to hold back the slag with a brick or dry sand core in the ladle lip.

In the teapot type ladle the metal flows up from the bottom through a spout as in a tea or coffee pot. A certain amount of slag always is present in the spout when the ladle first is filled and has to be skimmed off before starting to pour the metal. This type of ladle while preferable to the first does not guarantee total exclusion of slag from the mold.

The bottom pour type ladle offers better insurance than either of the other two in preventing slag from entering the mold with the metal stream. Occasionally slight trouble is experienced through fusion of the lining.

A skimming device developed by J. H. Crawley and shown in Fig. 241 is claimed to prevent the entrance of slag into castings weighing up to 3000 pounds even where the steel is poured directly over the lip of the ladle. The skimming device is made as a three part core and in the assembled form is placed over the sprue opening where the metal is poured directly into it. In addition to molds for steel castings the device has been employed with equally satisfactory results on iron and bronze castings.

No Skimming Necessary

Where this device is used, it is claimed that it is not necessary to skim the metal in the ladle. No slag will enter the mold where the runner is kept filled with metal. This skimming runner may be made in various sizes to suit the requirements of any given lot of castings. The metal from the ladle enters the top core *A* and flows through a number of small vertical openings situated near the perimeter of core *B*. The size and number of these openings determine the volume of steel which flows into the chamber in core *C* where the molten metal passes under the dam or ring projecting downward from core *B*. After passing this barrier the metal rises again and then flows down through the central sprue in core *C* and thence into the sprue opening in the cope of the mold. Direction of the stream from top to bottom is indicated by the arrows.

No claim is advanced that the foregoing, or indeed any type of skim

(*Continued on page* 36)

Use Skim Gates

STEEL from the nozzle of a bottom pour ladle usually is free from slag or other foreign inclusions, therefore a strainer, skimmer or other form of dirt catcher in the runner and gate passages would serve no practical or useful purpose. To a considerably lesser extent the same is true where the metal is poured from a teapot type ladle and where the metal first enters the spout from a point near the bottom of the ladle. This condition does not obtain where the metal is poured directly over the lip and where the hazard always is present of some of the slag flowing into the runner with the metal. Prudence would seem to suggest in cases of this kind that a skimming device of some kind, as found in gray iron foundries, should be incorporated in the passage through which the metal flows before it enters the mold.

Sign name and address on margin —tear out, mail today for your copy describing many Airless WHEELABRATOR installations.

THE AMERICAN FOUNDRY EQUIPMENT COMPANY

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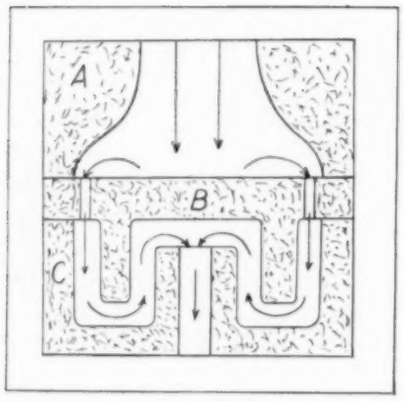

Fig. 241—The runner core is made in three parts, pouring cup, strainer and sprue

(*Continued from page* 34)

gate is a cureall for every form of casting defect, or even for all castings in which foreign inclusions may be found. Dirty areas on a casting, in some instances resembling slag inclusions, may be due to unfavorable conditions in the mold and in no manner attributable to the metal or the manner in which it is poured. The skimming device offers definite protection against one potential hazard and seems worthy of more wide spread adoption.

Fig. 242 shows a simple type of runner cup with a strainer core in the bottom, which has been used with gratifying success for several years in a prominent eastern steel foundry where the metal is taken from a converter and poured over the lip of the ladle. Slag and dirt effectually are prevented from entering the mold One of the principal advantages is that it requires no elaborate equipment. Also no exceptional skill is required on the part of the operator who makes the cups ready for the daily heats.

Sizes may vary to suit individual conditions. In the illustration the light steel runner box is 9 inches deep and 10 inches square. This leaves a minimum thickness of 1½ inches of sand between the sides of the box and the 7-inch diameter runner basin. The only pattern equipment required is a tapered block in three steps and a plain circular corebox 6 inches diameter, 1¼ inches deep and provided with 39 tapered pins equally spaced. In the example shown the pins taper from ⅜ to ¼-inch. The outer edge of the core also is tapered so that it fits tightly in the bottom of the cup at the first shoulder.

Place Strainer Core

In practice the runner box is rammed on a jolt machine and dried. Then it is placed on the cope of a mold with the small hole in the bottom directly over the sprue opening in the cope. The strainer core then is dropped into place and the runner is ready for the metal. It is not necessary to anchor the core with nails or otherwise. Provided it is a reasonably tight fit, it will remain in place during the pouring operation. In some instances where the runner is drained out clean, it may be used a second time.

Temperature Too High

In an inquiry which appeared in THE FOUNDRY a few years ago a foreign steel foundryman stated that the sand seemed to fuse on the face of his heavy castings. He described the facing sand and enclosed a sketch of a 7½-ton ring casting, 10 feet diameter, 20 inches deep and 8 inches thick. Metal was poured into a runner over the center of the mold and was conducted into the mold cavity by two long gates extending from near the center on a diametrical line. Four large risers were spaced equidistantly on the top of the ring. The metal remained liquid in the heads for over 2 *hours* and the casting was exceedingly rough on the surface after it was taken from the mold. Steel rolls come out of the sand in the same condition with a coating of sand fused on the surface. He wanted to know whether he was pouring the metal at too high a temperature, or, if the facing sand was at fault.

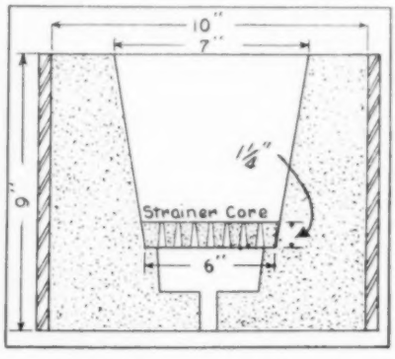

Fig. 242—The tapered strainer core is held by gravity in the bottom of the cup

The writer who answered the inquiry stated that if the translation of the letter was correct in the item which said that 8-inch square risers remained liquid for 2 hours, he was in no position to offer advice of any kind. He never had seen or heard of steel that would remain liquid in a head of that size for 1 hour or even for half an hour. Furthermore he could not conceive of any mold material that would withstand the temperature of metal of that kind.

Assuming that the figure is a slip in the translation, it is still apparent that the metal in the heavy castings is poured at an unnecessarily high temperature. Of course the steel must be exceedingly hot for the small castings, but the larger castings should be poured at a much lower temperature. From the statement that he pours large castings including 15-ton rolls, one may assume that he employs a single large bottom pour ladle. Under the circumstances, two courses of action are open. One is to pour all the light castings first, then allow the metal to cool in the ladle and afterward pour the heavy castings. The second method is to pour the small castings from a small ladle and reserve the large ladle for the heavy castings.

Should Be Poured First

The natural objection to the first method is that practical foundry experience suggests that the heavy castings should be poured first while an ample supply of metal is available. If a small casting is poured short at the close of the heat the loss is not great. Pouring a large casting short or standing by without a reserve supply of metal in the event a large mold develops a leak means a heavy loss. Also if a surplus of metal is left in the ladle after a heavy casting is poured, it is too cold to be poured into small molds.

The second is the logical method and is the one practiced almost universally in this country. In bessemer converter and electric furnace foundries the metal is tapped into a teapot ladle of from 1 to 3 tons capacity. Small castings in some instances are poured over the lip and in other instances the metal is transferred to the ordinary type of double shank ladle handled by two men. In the case under discussion the foundryman easily could fill a teapot ladle from a large bottom pour ladle and use that metal for the small castings. The amount of metal remaining in the large ladle may be weighed or estimated and allowed to cool to a suitable temperature before it is poured into the large castings.

According to the silica content of

(*Concluded on page* 39)

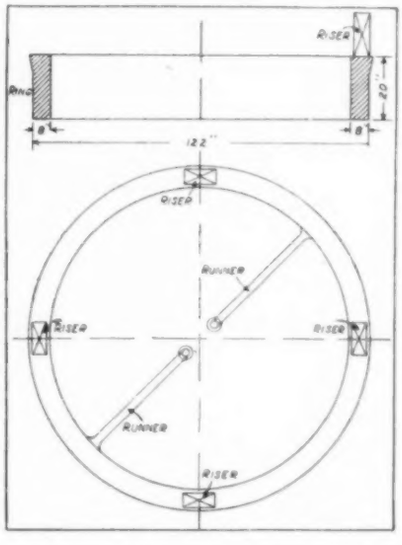

Fig. 243—Metal entered the mold at the bottom through two long diametrical runners

(*Concluded from page* 36)

the sand given in the inquiry, the sand should prove satsifactory if the steel does not exceed ordinary casting temperature. In this country a satisfactory skin is secured on the casting by the use of sand which does not fuse under a temperature of 1600 degrees Cent. (2912 Fahr.). Pulverized silica mixed with molasses water or any other form of diluted water soluble core binder is used for a wash on the surface of dry sand molds and cores. In the early days of the steel foundry industry, many mixtures were made up including pulverized crucibles as one of the principal ingredients both for a facing and a wash. They are no longer used. The clay in the mixture lowers the fusion point and causes the sand to *burn on* to the face of heavy castings. The ideal binder is one that is consumed by the heat and leaves no residue. Spraying the face with alum water imparts a hard surface and helps to secure a clean face on the casting.

While on the subject of large steel rings it is interesting to note that a Mid-West steel company has developed a method for casting 10-foot diameter blooms by the centrifugal process. The bloom is cut after it is cast, straightened out and then is ready for passage through any of the finishing mills, thus eliminating the blooming mill where in ordinary practice the ingot first is rolled into blooms.

Exerts Constant Pressure

A predetermined amount of steel is poured into a rapidly revolving horizontal mold made up of a top, a bottom and a circular back wall. Centrifugal force presses the metal against the three confining walls in the manner of the familiar example where a man whirls a can of water in an arm length circle. So long as the bottom remains in the can, none of the water will be spilled.

Harking back to the chapter on the laws of liquid pressure, it will be seen that a constant horizontal pressure is maintained against the body of steel in the mold until it solidifies. Hence the resulting casting is solid and homogenous throughout although it has not been fed from a number of vertical heads in the usual manner.

Designed primarily for the production of rolling mill blooms, elimination of the blooming mill and practically total elimination of crop ends, it would seem that the process might be adopted to some extent in the foundry for the production of circular castings. In addition to securing solid, homogenous metal in the casting, adoption of the method would effect a considerable saving in the manipulation of the metal through elimination of gates and risers. Initial expense of the equipment probably would militate against its adoption except in those foundries where it might be used continuously.

A saw mill carriage wheel 20 inches diameter with web center and heavy rim is fairly typical of a wide range of steel castings in which cavities frequently are found in the rim after the risers are removed. Castings of this kind are made in open-hearth, electric furnace and bottom or side blow converter foundries. Therefore in diagnosing the trouble in any given instance, little attention need be paid to the metal or to method of melting.

If the cavities appear only under the risers the reasonable assumption is that the feeding heads are not performing the function for which they were intended. Either they are not sufficient in number, too small in the body, or the neck is constricted to a point that causes the metal in it to freeze before the metal has ceased to draw metal from the sinkhead. The logical remedy is to increase the size and possibly the number of risers until a solid casting is secured.

To a certain extent, the gating detail will vary somewhat depending on whether the mold is green or dry sand, or whether the metal is poured over the lip or through a nozzle in the bottom of the ladle. To compensate for the chilling effect, the risers on a green sand mold should be slightly larger than the risers on a corresponding casting in a dry sand mold. Thus while four 6-inch risers, one on the hub and three on the rim may be adequate on a dry sand mold, the size should be increased to 6½ or 7 inches on a casting made in a green sand mold.

The best way to gate the casting either in a green sand or a dry sand mold is to extend the hub full size to the top of the cope and then pour the metal into the hub through the combined pouring cup and strainer shown in Fig. 242.

This is the fifty-fifth of a series of articles dealing with the various types of gates and risers used in the foundry industry. The fifty-sixth instalment will appear in an early issue.—THE EDITORS.

To Handle Trade Practice Complaints

Approval has been given by the NRA administration for the trade practice committee to handle all trade practice complaints arising under the code authority for the refractory industry. The members of the trade practice committee are: Roger A. Hitchins, American Refractories institute, Philadelphia; A. P. Green, A. P. Green Fire Brick Co., Mexico, Mo.; F. L. Greon, General Refractories Co., Philadelphia; J. E. Lewis, Harbison-Walker Refractories Co., Pittsburgh, J. D. Ramsay, North American Refractories Co., Cleveland; H. L. Tredennick, Haws Refractories Co., Johnstown, Pa.; and W. J. Westphalen, Laclede Christy Clay Products Co., St. Louis.

Grants Exemption To Nonferrous Group

The National Recovery Administration on Aug. 2 announced approval of the application of the code authority of the nonferrous foundry industry for termination of exemption granted under administrative order X-36 of May 26, 1934, whereby members of the industry, whose principal line of business is covered by another code, were exempted from the necessity of contributing to the cost of administration of the nonferrous foundry code.

However, it is provided that termination of the exemption shall be limited to those members of industry whose foundries produce nonferrous castings as defined by the code of fair competition, whether processed or not, for sale as castings, and this termination of exemption shall not apply to those members of industry whose foundries produce processed nonferrous castings all of which are sold as parts or products covered by the definitions of others codes.

The code authority submitted a statement showing the estimated total dollar volume in the industry to be $21,500,000. Of this total 40 per cent is done by those whose principal line of business is in that industry. If the entire industry is assessed two-tenths of 1 per cent of the dollar volume, all necessary to cover the budget will be provided. On the other hand without the exemption sought that part of the industry whose principal line of business is the production of nonferrous castings would be forced to an assessment 150 per cent larger than otherwise.

Joins Sales Staff

James C. Vignos recently has become connected with the sales division of the Ohio Ferro-Alloys Corp., Canton, O., in the Eastern district. Mr. Vignos was graduated from Notre Dame university, South Bend, Ind., in 1925 with an A.B. and an M.S. degree in chemistry, and spent the following year in post graduate work in chemistry and metallurgy under the DuPont fellowship. During the past 8 years he has devoted his efforts to the metallurgical and chemical field, specializing in the production of iron and steel alloys, and high strength cast irons.

Interprets Code

According to a recent interpretation of the NRA, the code authority of the gray iron foundry industry shall not interpret "any calendar 6 months period" in section 4 of article IV of the gray iron foundry industry code to mean that the starting of said period may be restricted to any definite date.

French Foundrymen Meet at Nancy

Papers on various problems encountered in cast iron production feature convention

By VINCENT DELPORT
European Manager, The Foundry

THE thirteenth annual convention of the Association Technique de Fonderie was held at Nancy, the principal city of the industrial district of Lorraine, July 20 and 21. The opening address was made by Prof. L. F. Girardet, president of the Association, who, in addition to his professional activities, is the proprietor of a foundry at Saint-Die.

The first paper, by A. Le Thomas, vice president of the association and director of the French center of foundry research, was on "Properties of Electric Cast-Irons." It is interesting to note that the American exchange paper by H. H. Walther, metallurgist, Dayton Steel Foundry Co., Dayton, O., entitled "Electric Cast-Iron Practice," deals with practically the same subjects; and, as Mr. Le Thomas pointed out after the presentation of the American exchange paper by Vincent Delport, European manager of THE FOUNDRY, European representative of the American Foundrymen's association, the authors of both papers arrived at almost the same conclusions.

These papers brought out the advantages of the electric furnace for the manufacture of high-grade cast-iron having the special qualities required in special fields of modern engineering. By using the electric furnace it is possible to control the melt to obtain, with practical certainty, high-duty cast-irons presenting the physical characteristics now required by industry. In commenting upon Mr. Walther's paper, Mr. Le Thomas stated that, in his opinion, to secure all the advantages offered by the operation of the electric furnace, long training and considerable experience are required. While the American paper dealt with the acid furnace, Mr. Le Thomas preferred the basic lining.

A paper by G. Henon, of the French center of foundry research, was entitled "Auto-Annealing of Irons Chilled in Thin-Walled Chills." The author bases his investigations on previous work by A. Le Thomas, who showed that improved characteristics could be obtained by melting castings under such conditions that practically all the carbon is combined, and then by submitting the castings to a heat-treatment, which transforms the structure into perlite and fine nodulous graphite, the latter being surrounded by a small quantity of ferrite. Subsequent investigations showed that to obtain very fine graphite, annealing should be effected at relatively moderate temperature, and should be of short duration. The paper deals principally with annealing by using the heat stored in the mold by the casting itself, this method being characterized by the use of chills placed in certain favorable positions, which are governed by the nature of the casting.

Improve Ordinary Iron

The exchange paper of the Czech foundry association was entitled "Investigation on the Improvement of Gray Cast-Iron," by Dr. H. Kern and Prof. Dr. A. Lissner. The aim of the authors was to study possibilities of improving ordinary cast-iron produced in the works. This is obtained by casting the metal in chilled molds, followed by normalizing treatment, which has the effect of precipitating the graphite in fine form. As a result of this treatment, a considerable increase in strength was noted, and hardness increased in relation to the increase of tensile. However, it was stated that the method described is still too complicated to be employed in practice.

Dr. G. Delbart and E. Lecoeuvre, of Etablissements Cail, Denain, presented a paper "Investigation on Certain Physical Properties of a Nickel-Manganese Austenitic Cast-Iron With Low Carbon Content." The authors have studied the mechanical, physical and chemical characteristics of such an iron susceptible of being used in practice. The iron investigated enabled the authors to emphasize certain phenomena relative to martensite and to the precipitation and redissolution of carbides. This iron presents a high modulus of elasticity, a high elastic limit, and an appreciable permanent deformation. Following the presentation of this paper, Dr. M. A. Ballay, of the French bureau of information on nickel mentioned that researches have been made on the hardening of cast-iron by the precipitation of graphite with the use of glucinum and aluminum.

Dr. Ing. E. Sohnghen, of the foundry institute of Aachen, Germany, presented a paper entitled "Certain Physical Properties of Cast-Iron." The paper reviews the subject from the point of view of magnetic properties, thermic conductivity, electrical resistance, thermic expansion. The results of the investigations show that it is possible to prepare irons with special characteristics of great value in practice, thus allowing for new openings in the use of cast-iron.

Prof. Seigle, of Nancy, read a paper entitled "Criticism of the Iron-Cementite Eutectoid Diagram and Suggested New Diagram," which deals with the iron iron-carbide diagram, applicable to white cast-irons and to steel. The author has found that the eutectoid diagram as known at present does not lend itself to correct interpretation of certain observations made during the course of micrographic, dilatometric and magnetic experiments. He considers that the diagram is not accurate up to 0.90 per cent carbon, and he suggests a different diagram, which appears better to represent the facts observed.

R. Colas submitted a contribution on "The Microscopic Study of Phosphorus Cast-Irons By the Staed-Kunkle Method." The method is based on the oxidation of the polished surface of a test-piece by heating it in air. The original Staed method has been improved upon, particularly by German investigators, and the various elements constituting the iron can be recognized through a microscope by their colors over a scale of temperature and time.

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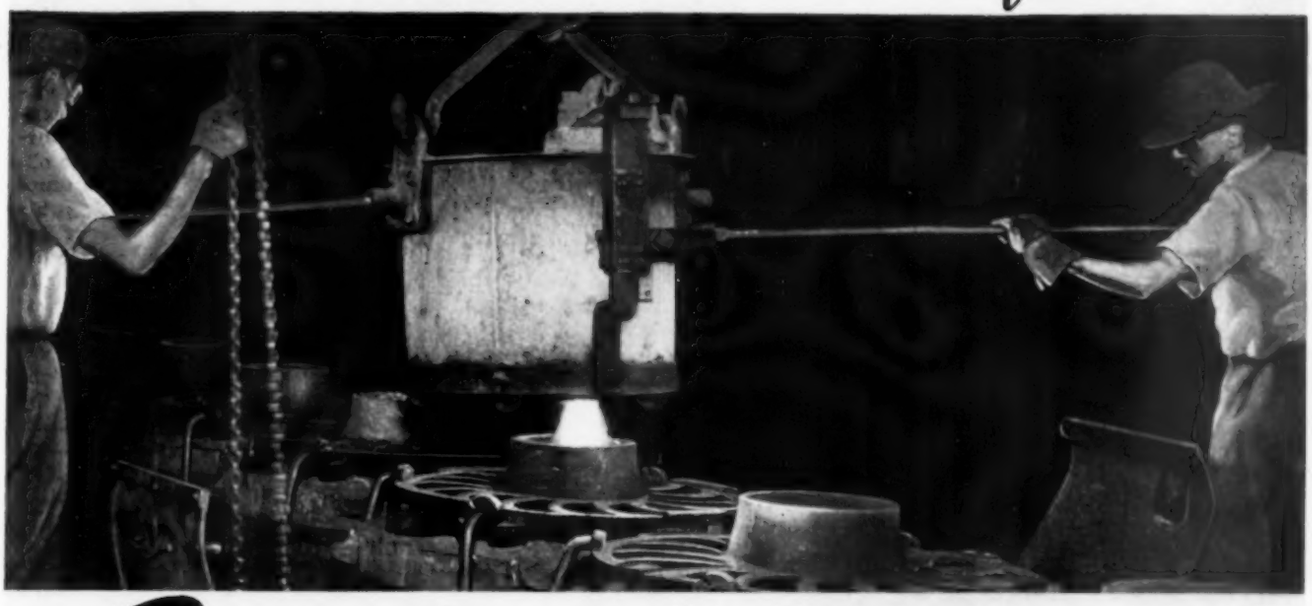
Foremost Railroad Car Manufacturer



Uses The GRIFFIN Hot-Blast Process

Replacement of two cold-blast cupolas by a single Griffin hot-blast unit at a mid-western plant of a railroad car manufacturer has resulted in substantial savings in coke, power, and man-hours of labor.

Other features of the installation are:

1. Chipping out hanging metal before patching seldom necessary.
2. Bridging over the tuyeres practically eliminated.
3. Lining at the melting zone burns out uniformly and never enough to require a new block brick for building out the lining.
4. Proper leveling of the charge facilitated by elimination of flames at the charging door.
5. Uniformity in casting shrinkage shown by uniform test pieces.
6. Blast pressure of 1 oz. holds metal temperature.

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Prof. P. Duez, of Etablissements Cail at Denain, presented a paper on "Separation of Titanium and Vanadium, and Their Determination in Titanium-Vanadium Cast-Irons." This paper describes a method which enables the determination of titanium and vanadium to be effected with great precision, but it is not claimed that this method is rapid. The test-piece is attacked by a solution of sulphuric acid, avoiding contact with air, and the solution then is treated with zinc oxide. Nickel, cobalt and maganese remain in the ferrous so. lution, while titanium, vanadium, chromium and molybdenum remain in the dregs with small quantities of iron oxide. Titanium is determined as $Ti\ O_2$, and vanadium is determined by permanganate of potash, after having been reduced to the state of sulphate of Divanadyle. A paper by A. Travers, director of the Chemical Institute of Nancy, described a method of determining silicon, molybdenum, chromium and vanadium in iron and steel. The methods for determining silicon and molybdenum are based on a color scale. These methods are recommended for speed and simplicity.

Scale Based on Cohesion

A paper by Dr. Ing. Meyersberg, Berlin, was entitled "Considerations on the Derivation of Mechanical Characteristics of Cast-Iron." These considerations are based on study of the cohesion of molecules. A scale of cohesion was given, in which cast-iron occupies the last place in its category. The author pointed out that while cast-iron does not present characteristics of tensile strength and elongation to the same degree as steel for instance, cast-iron has certain characteristics of its own which make it eminently suitable for certain uses to the exclusion of other materials. The author emphasized the importance of these considerations at a time when cast-iron is subject to various forms of competition, and he laid stress on the special properties of cast-iron to damp vibrations, which renders it suitable for use in the manufacture of bed-plates.

The French foundry association, in co-operation with other bodies, has devoted a considerable amount of time to the study of testing methods for cast-iron, and the Fremont shearing test on small test-pieces extracted from a casting is much favored in France. Major P. Nicolau, president of the committee on testing methods of the French association, gave a paper entitled: "All Cast-Iron Tests on One Test-Piece." Following a large number of investigations and experiments, a test-piece similar to that used in the Fremont test has been devised. It is a cylindrical test-piece having a section of 25 square millimeters (0.0385-inch) and 60 millimeters (2.36 inches) long, which can be extracted in 12 minutes, by a special cutter. The use of this test-piece with specially-devised testing apparatus enables the following tests to be effected: Shearing, compression, static transverse, shock transverse and alternating transverse tests, modulus of elasticity, and also such physical tests as magnetism resistivity, thermo-electicity, and density. The same test-piece can be used with the Chevenard dilatometer and for micrographic examination.

The Polish foundry association presented an exchange paper entitled: "Contribution to the Standardization Scheme for Steel Castings," by Ing. Otton Marcinowsky.

The Institute of British Foundrymen presented an exchange paper by E. Longden, Craven Bros. Ltd., Manchester, on "Factors That Influence the Density and Soundness of Ferrous and Nonferrous Castings." The author dealt specially with the influence on porosity of dissolved and trapped gases in the metal. He laid stress on the influence of gases that are produced by the materials making up the mold, and dealt with the influence of the materials of the mold on the constitution of cast alloys. Dr. Ing. Henry Lepp, Compagnie Generale d'Electro-Metallurgie, confirmed Mr. Longden's conclusions regarding the increase of tensile strength and elongation that can be observed after degasification in vacuum.

The exchange paper of the Association Technique de Fonderie, Belgium, was entitled "Influence of Linseed Oil Incorporated in Foundry Sands and Cores on the Constitution of Cast-Iron." This paper is the result of investigations made by the Technical Committee of the Belgian association, who show that when the bottom of a deep mold is imbibed with linseed oil, dried at a temperature of about 320 degrees Fahr., the bottom part of the mold becomes hard, does not give out much gas, and resists shocks and high temperatures better. On the other hand, linseed oil applied on the walls of molds creates a porous zone underneath the hard zone, with the result that an abundant quantity of gas may, under certain conditions, go through the metal. The quality of the linseed oil is a factor of importance, and it was found that the best results were obtained with raw linseed oil.

Another paper on sands was by Dr. Ing. Nipper, of the Foundry Institute of Aachen, Germany, entitled "Influence of Increasing Additions of Water and Clay on the Properties of Core Oils, Either Dried or in the Green State." Following this paper, Mr. Girardet, who has devoted considerable time to the subject of sands, pointed out that oil and clay are antagonistic. If a sand contains clay as a binder and if oil is added to that sand, part of the oil will be lost. This is confirmed in Dr. Ing. Nipper's paper.

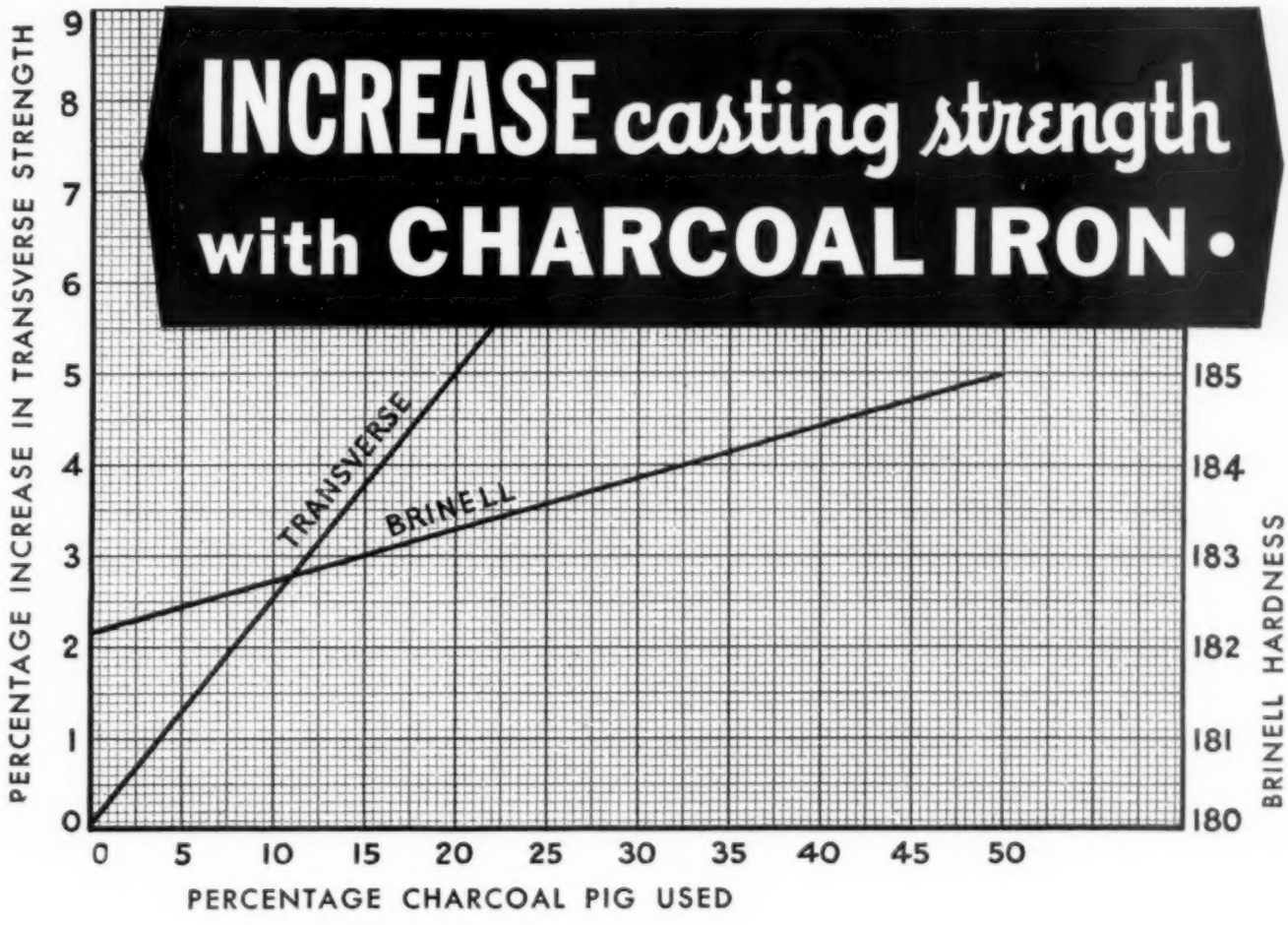
L. F. Girardet presented a paper entitled: "Present Position With Regard to Foundry Sands: Rapid Method to Determine the Necessary Remedies." The paper describes experiments the author has conducted during the past 2 or 3 years with the object of finding the fundamental properties of sand. In presenting his paper, the author gave practical demonstrations of various simple experiments which he has made in the course of his investigations.

A paper by P. Barrant, Societe L'Aluminum Francais, describes developments in manufacture of light aluminum alloys, together with the high mechanical characteristics which are now obtainable with these alloys, and possible uses. R. Satet, director of the bureau of scientific organization of Union des Industries Metallurgiques et Minieres, Paris, contributed a paper on "Budgeting of Undertakings," in which he reviews the methods of establishing budgets for the various departments of an undertaking, including sales, production, purchase of raw materials, expenditure, investments, capital, and general budgeting.

For Quick Determination

During the visit to the laboratory of testing materials at the school of mines and metallurgy at Nancy, P. Le Rolland gave an interesting demonstration of an apparatus which enables a quick determination of the modulus of elasticity of a metal or alloy. The method is based on the property of two identical pendulums to oscillate in sympathy. The test-piece is in the form of a T, and the pendulums are placed on each branch of the T at about equal distance from the center. If an oscillation is given to one of the pendulums, this oscillation will immediately begin to damp down, and at the same time the other pendulum will begin to oscilate. The oscillation of the second pendulum will increase in amplitude, while that of the first will gradually go down to zero. Then the oscillation of the second pendulum will damp down, and the first pendulum begin to oscillate again. Were there no resistance and no friction, the two pendulums would oscillate alternately indefinitely. The time that elapses between two complete cycles of one of the pendulums is a measure of the modulus of elasticity of the metal that is being tested. An apparatus has been built on this principle which enables the modulus of elasticity to be measured quickly and accurately, and which has the advantage of enabling the value of the modulus of elasticity to be obtained practically at the origin of the elasticity curve.

INCREASE casting strength with CHARCOAL IRON •



AN extended series of tests carried out in the foundry of a large automobile manufacturer was conducted to find out definitely just how much the use of charcoal iron would increase cylinder strength.

No alloys were used in any of the mixes during this investigation. All coke used had the same physical properties and cupola conditions were maintained as nearly constant as possible. Blast pressure was not allowed to vary more than two ounces. The molten metal temperature at the spout varied from 2602°F. to 2678°F. and averaged 2652° for all heats.

The accompanying curves tell the story of what happened. It is a significant fact that as tensile strength increased, hardness showed practically no change. With a 12% increase in transverse strength, the Brinell hardness increased less than 3 points. There was practically no decrease in machinability in the stronger irons.

You too can get stronger castings without added machining costs by the use of our pure charcoal pig iron. Write for suggestions on special cases.

Superior Charcoal Iron Company
Grand Rapids, Michigan
Debevoise-Anderson Co., Inc., *Eastern Representative*
New York • Boston • Philadelphia

Superior PURE CHARCOAL PIG IRON

ControlsCupolaMeltingOperations

(*Continued from page* 14)

accuracy, the management of the foundry believes that the indicated temperature may be in excess of the actual temperature of the metal. However, by maintaining the indicated temperature at 2900 to 2925 degrees Fahr., the necessary control is obtained and the most satisfactory castings secured.

Selection of a proper base metal is given first consideration in the production of a high test gray iron. The company points out that when using a 40 per cent steel mix, 4 per cent silicon, low phosphorus pig, and without alloys, it should be possible to secure the following physical properties: Tensile strength 40,000 pounds per square inch; transverse strength 3900 pounds; deflection on 12-inch centers 0.14 inch; brinell 200. Using a 50 per cent steel mix, the tensile strength should be 44,000 to 45,000 pounds per square inch. Alloys should increase the tensile strength from 5000 to 6000 pounds per square inch, depending on the amounts used. In the light of properties which the company feels may be expected, it is interesting to examine several typical charges and the physical properties of the resulting castings.

Shows Typical Mixtures

The charge for metal to be poured into a heavy lathe bed, having a swing of 36 inches and weighing 500 pounds to the foot, was as follows:

Steel scrap (rails)	1000 pounds
4 per cent bessemer pig iron	500 pounds
Return high test scrap	500 pounds
Spiegeleisen, 16 per cent manganese	75 pounds
One-pound silicon briquets	10
Two-pound chromium briquets	3

The chemical analysis of the metal was as follows:

	Per cent
Silicon	2.04
Manganese	0.68
Phosphorus	0.18
Total Carbon	2.98
Chromium	0.27

The higher chromium content than would be possible through the addition of the briquets alone is due to the chromium picked up from the returned high test scrap.

Physical properties were as follows:

Tensile strength, pounds per square inch	53,000
Transverse load, 12-inch centers, pounds	4800
Deflection on 12-inch centers, inches	0.17
Brinell hardness	248

A typical charge to be poured in lighter castings with thinner sections was as follows:

Steel scrap (rails)	800 pounds
4 per cent bessemer pig iron	500 pounds
Returned high test scrap	500 pounds
Cast scrap	200 pounds
Spiegeleisen	75 pounds
One-pound silicon briquets	15
Two-pound chromium briquets	2

The chemical analysis of the casting was as follows:

	Per cent
Silicon	2.28
Manganese	0.58
Phosphorus	0.17
Total Carbon	3.08
Chromium	0.20

Physical properties of the casting from that charge were as follows:

Tensile strength, pounds per square inch	47,000
Transverse load, 12-inch centers, pounds	4500
Deflection on 12-inch centers, inches	0.17
Brinell hardness	228

The analysis of the pig iron used in these mixtures was as follows:

	Per cent
Silicon	4.00
Sulphur	0.027
Phosphorus	0.20
Manganese	1.02

Micrographs of the second iron, which has a tensile strength of 47,000 pounds per square inch, are shown in Figs. 2 and 3. The iron has a good grain structure, with a pearlitic matrix and no free cementite is present.

The metal is tested in a number of ways to provide further assistance in maintaining absolute control. Standard 1¼-inch test bars, poured in dry sand molds, are made from each heat. Dry sand molds are used to secure more uniform results in test bars from day to day. The bars are blasted and machined to 0.8-inch for making the physical tests. A chemical analysis also is made. The spiral fluidity test, with a slight variation in the size of the gate to meet the conditions imposed by the type of metal being tested, also is used. In addition, a step block for a fracture test is poured from every heat going into important work. The block has thicknesses of 2, 1½, 1, ½ and ¼ inches. The block is split and by observing the grain structure of the fracture, it is possible to make a quick determination of how the metal was melted and the thickness of section for which the particular metal best is adapted.

As previously mentioned accurate records are kept of the charge and several important details of practice. A daily report shows the time from the start of the blast to the first iron that passes the tuyeres, the length of time required to get the metal down for the first tap and the length of time of melting the heat. The latter is used in calculating the rate of melting and shows any variations from the charging standards. These records together with data on the charge analysis and physical properties etc., are filed as a part of the permanent history of the job.

A simple test is used to secure practical information on the wear resisting properties of the heats of high test iron produced by the company. Iron from the various heats is poured into molds of sandblast nozzles, and these are used in the regular blasting operations of the shop to determine the length of life. To make this test uniform, a gage is provided for each size of nozzle. When that gage or plug will just slip into the nozzle opening, the part is considered worn out. Results of this test are recorded carefully.

Mark Oven Iron Pigs

Over iron and return scrap from the high test heats form an important part in making up the charge for producing that class of castings, as may be noted in the two charges previously mentioned, and therefore that material is segregated carefully. Pig molds are located at the cupola and at one end of the molding floor for the over iron from the high test heats. These molds have special markings which are reproduced in the pigs and provide an easy means of identification.

The company is using a refractory shape to make a teapot ladle from an ordinary ladle. The front and back views of the block and a ladle equipped with a block is illustrated in Fig. 6. This block is placed in the ladle with the pronged end down, and is held in place with the same refractory material used to coat the refractory lining. The company expects soon to use a similar shape in its bull ladles.

While a foundry has been operated on the present plant site since 1896, the shop was purchased by the present owners in 1916. The company is well equipped for the production of the special line of castings and recently numerous plant improvements have been made, including the construction of additions to the foundry buildings and the installation of new equipment.

The main foundry bay, which consists chiefly of new construction, is 40 x 300 feet, and is served by three 10-ton traveling cranes and two jib cranes. Molds are made on the floor in a little over half of the building and are cleaned and shipped at the opposite end.

A core department is located in a bay 30 x 150 feet along side the molding floor. The core department is served by the two jib cranes previously mentioned, and by a 5-ton traveling crane. The jib cranes, located between the two departments, are

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ADVERTISING PAGES REMOVED

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used for handling either cores or molds, for transferring cores from one department to the other, and for setting cores in molds. All core sand, and all facing sand is mulled and then passed through an aerator and blender. Cores are baked in two oil fired, automatically controlled core ovens of the car type, as shown in Fig. 5. When operating at a high rate, one oven is used for small cores and the other for large cores. Under restricted operations, all sizes of cores are baked in the same oven at 410 degrees Fahr. When the small cores are baked, the car is pulled, the small cores removed and the large cores then returned to the oven.

Flasks are stored in the yard, just outside the molding department, and are handled by an overhead traveling crane and transferred to the molding department on an industrial car. The company also maintains an exceptionally large pattern storage, and a pattern shop employing three men, where such changes as may be desired by the customer are made. Castings are cleaned in a car type blast room, as is shown in Fig. 4.

Phosphor Tin Made by Several Methods

Phosphor tin can be prepared according to a number of methods. While either red or yellow phosphorus may be used, the red variety is the safer although it also is the more expensive. Considerable difficulty will be experienced in adding the phosphorus to the tin if the tin simply is melted and then the phosphorus added by stirring. Molten tin will fly and spatter from the wet phosphorus. A thick coating of bone ash or some similar material over the molten tin will facilitate the operation.

Experience seems to show that the best method is first to granulate or feather the tin by melting it and pouring it into water. The prepared tin then is packed in a crucible in sandwich layers with the phosphorus between layers of tin. The last or top layer of tin is heavier than the others. The crucible is heated in a furnace which fires the phosphorus and this in turn melts the tin and forms the alloy or admixture.

Extra phosphorus must be placed in the crucible to compensate for that lost in the mixing process. The assumed loss on yellow phosphorus is 50 per cent, but personal experience has shown the loss is much less.

Red phosphorus is not as dangerous to handle as the yellow variety, which has to be kept under water and which bursts into flame spontaneously when exposed to the air. The red phosphorus is quite safe to handle and for that reason is preferred by the occasional brass founder who desires to make his own phosphor tin. The practice practically has been abandoned in recent years on account of the ease with which this and nearly all other alloys can be secured from metal manufacturers and distributors. Where the alloy is made on a commercial basis for resale in ingot form, yellow phosphorus is employed instead of the more expensive red variety.

Ford Runs Foundry At the Fair

(*Concluded from page* 16)

the removal of the castings from the mold as the head opens automatically. The purpose and the steps in the melting and casting operations are explained to the audience through a loud speaker by an announcer who has been trained carefully.

To better acquaint the thousands of visitors with the work and problems of the foundryman, supplementary exhibits round out the story told by the actual operations previously described. An exhibit of green sand molds is located next to the permanent mold machine to illustrate the casting of metal in sand. The mold on exhibition is that for casting the V-8 engine block, described in THE FOUNDRY for May, 1934. That mold contains 43 different cores. Further down every core used in casting Ford products is shown on a revolving turntable. Another display illustrates the various steps in casting the V-8 crankshaft, described in THE FOUNDRY for April, 1934. This display shows the mold, which is made up entirely of cores, the mold with the casting, the casting following the shakeout, and the finished crankshaft. A display also shows one of each of the various gray iron castings produced in the Ford foundry, a core-making table, and a small electric core oven in which cores for valve tappets are baked in view of the spectators.

Beyond are bins containing the three elements in the manufacture of iron, namely coke, iron ore and limestone. In addition the display includes a working model of a conveyor bridge with a boat unloader, a cutaway model of an ore-carrying boat, a cutaway model of a blast furnace, a cutaway model of an air preheating stove, and numerous other models.

An idea of the magnitude of the exposition as a whole may be gained from the fact that the iron and steel exhibit in Industrial hall is one of five phases of the entire exhibit. The other four are the Ford Drama of Transportation, a collection of ancient, medieval and modern vehicles from the Egyptian chariot to the millionth Ford V-8; the Ford Museum containing relics of the early inventions of Henry Ford and Thomas A. Edison; the Ford Industrialized Barn which presents what has been called "Henry Ford's solution of the Farm Problem"; and the Roads of the World, an exhibit in the 5-acre gardens fronting the building on the east and showing the history of road building from prehistoric times to the present.

Decreases Opportunity For Employment

Farrell-Birmingham Co., Ansonia, Conn., has prepared a series of booklets, written by Allen W. Rucker in collaboration with N. W. Pickering, president of the Ansonia organization.

The most recent booklet, No. 7 of the series, discusses the question of private initiative versus planned economy. How the restriction on management has decreased rather than increased opportunity for employment, though arbitrary shortening of hours and raising wages does not promote prosperity, but interferes with the productivity of workers is shown. Desirable exchange relationship between various classes of goods, is necessary to economic prosperity and social advancement. It points out that between March, 1933, and February, 1934, the average increase of the weekly wages of the factory worker was 14.5 per cent, while the increase in food prices was 20 per cent and in clothing prices, 28 per cent. Manufacturers recognize that it is necessary to increase productivity per worker as much as to increase dollar wages, thus holding unit costs down, and thereby, making selling prices low enough to promote volume business.

Book Review

The Modern Encyclopedia, edited by A. H. McDannald, cloth, 1327 pages 6 x 9¼ inches, published by Wm. H. Wise & Co., New York, and supplied by THE FOUNDRY, Cleveland, for $3.50 plus 15 cents postage and in Europe by the Penton Publishing Co. Ltd., Caxton House, Westminster, London.

This handy reference to an exceedingly wide variety of often used information contains 22,000 individual articles. The work is compact and the articles concise, making the volume as easy to use as a desk dictionary. At the same time, it outlines the whole cycle of sciences, humanities and arts.

While the work has been condensed greatly to cover the wide scope, it represents carefully selected subjects, fully treated for a brief reference. The work was compiled by the staff of the Encyclopedia Americana. Undoubtedly it fills a need for a brief but accurate reference of a wide variety of subjects.

Heat Treatment of Cast Iron

(*Concluded from page* 20)

ily is preserved in gray irons. However, if silicon is high or cooling just below Ar_1 very slow, some or in extreme cases even all of the combined carbon of the pearlite is broken down, ferrite and more graphite being formed. The tendency toward completion of graphitization below Ar_1 lessens with decrease in temperature and at say 900 degrees Fahr. ordinarily does not take place within any reasonable time.

If considerable phosphorus is present a thermal arrest occurs above Ar_1, usually at about 1740 to 1800 degrees Fahr. This is due to separation of a phosphorus rich formation containing, at that temperature, austenite, iron carbide, and iron phosphide. On slow cooling the iron carbide diffuses out of the formation and the ordinary phosphorus formation in gray iron, known as steadite, is largely a binary formation of iron and iron phosphide.

These arrests on cooling are shown in Fig. 13. An iron very low in silicon, or metal cooled rapidly, as against chills, is not graphitized, the structure above Ar_1 consisting of cementite and austenite and below that temperature being made up of cementite and pearlite or in some cases cementite and martensite. Such material, shown in Fig. 2, is known as white or chilled iron. Forms intermediate between white and gray iron are known as mottled iron, shown in Fig. 3.

Interesting changes result when various heat treatments are applied to the gray iron casting. A small perfectly gray sample was heated to 2000 degrees Fahr. and quenched in oil. Reappearance of cementite may be noted in Fig. 6, shown at 100 diameters. A close up of this structure is shown in Fig. 7, at 1000 diameters. The spangled acicular matrix may be noted beside the particle of cementite. A polished sample shows the disappearance of graphite flakes. Thus quenching from just below the melting point results in resolution of graphite and retention of part of this *recombined* carbon as cementite. The matrix is not pearlite but tests show it magnetic and the metal is very hard.

Another sample was quenched from well above the Ar_1 point. It is necessary to go beyond the Ac_1 point, higher than the Ar_1 point, because of hysterisis. Examination of the plain polished sample shows about the same amount of graphite flakes as before treatment but tests show the hardness has been increased from say 200 to 500 brinell. Examination of the matrix at high magnification shows the structure depicted in Fig. 8. This structure is magnetic, hence not the nonmagnetic austenite stable above Ac_1. It is very hard and has a different structure than pearlite. It is known to metallographists as martensite and is one of the transition forms between austenite and pearlite. Even most drastic quenching of plain cast irons will not preserve fully the austenitic structure. Ordinarily water and oil quenching produce a predominantly martensitic structure. Milder quenching may produce some troostite and more often sorbite. Sorbite is a pearlite so finely divided it is not easily resolvable by the microscope. It is somewhat harder and stronger than ordinary pearlite.

Quenching of white iron from just above the Ac_1 point ordinarily does not produce a change in the free cementite structure but if an original chilling did not produce some martensite, quenching will. The same applies with mottled iron.

If a gray iron is heated to above Ac_1 and cooled slowly to 1200 degrees Fahr. or below the structure will consist largely of graphite and ferrite as shown in Fig. 10. This effect also can be produced by very long anneals above 1200 degrees Fahr., but the change is more rapid with higher top temperature. If the top temperature is raised, say to 1800 degrees Fahr. there is likelihood of coarse grain formation. It may be mentioned that steadite is reabsorbed by long exposure to temperatures of 1600 degrees Fahr. or above. A particle partially reabsorbed at a 1600 degrees Fahr. anneal is shown in Fig. 11.

White iron on the other hand usually is changed little by anneals below 1500 degrees Fahr. When the temperature is raised to 1600 to 1700 degrees Fahr. the cementite breaks down, temper carbon being formed. This is the typical malleable iron treatment and the resulting structure is shown in Fig. 12. The graphite being formed while the metal is fairly rigid assumes an allotriomorphic form, temper carbon, as distinguished from the more nearly isomorphic flake formation initiated in gray iron in the plastic stage just below solidification.

Long heating of steel just below the critical range results in agglomeration of the cementite lamellae of the pearlite, producing what is known as spheroidized pearlite. In gray iron this matrix condition is not easily attained because of graphitization within this range.

Addition of alloys and treatments like superheating often greatly modify the temperatures etc. involved in heat treatment. The tendency toward graphitization may be hastened or retarded, the proper quenching temperature raised or lowered, and the critical quenching speed materially modified. The action of nickel is chosen as illustrative of these phenomena, remembering however that each *alloy* acts differently, either in degree or in direction. Also the quantitative actions depend on the base iron.

Additions of nickel up to say 1 per cent slow down slightly the susceptibility of the alloy to complete annealing below Ar_1, lower the critical quenching temperature say 40 degrees Fahr. for 1 per cent nickel, and decrease the critical quenching speed. At about 2 per cent nickel the critical temperature is lowered further so that the cast structure is rather sorbitic and air quenching produces some martensite. At 8 per cent nickel the structure is largely martensitic as cast. At 18 per cent nickel the alloy is austenitic as cast, hence nonmagnetic and soft, because the ertical temperature has been lowered to below room temperature. Hence heat treatments are without much effect on the matrix.

In addition to nickel, other alloys including chromium and molybdenum have been used to good advantage, either singly or in combination to modify heat treating effects. Fig. 14 illustrates in a general way the effects of various heat treatments on cast iron.

This is the first of two articles by Mr. Bolton on the subject of heat treating cast iron. The second and concluding article will be presented in an early issue.

THE EDITORS.

All Scrap Mixtures May Cause Heavy Losses

Difficulty often is encountered in making castings from all scrap brass, since the composition of the material is not known. Many defective castings may result. For example some of the scrap may be bronze deoxidized with silicon; some of it may be yellow or red brass containing lead, and some of it may be aluminized yellow brass, not forgetting the possibilities of finding aluminum bronze, and alloys containing nickel or manganese. The various combinations enumerated in themselves are useful alloys, but grief will ensue when some of them are mixed together.

Brasses containing aluminum are useless for pressure castings as the metal is subject to leakage. Silicon will unite with lead to form lead silicate which makes a grayish dross that is carried into the mold. Small quantities of nickel which may be in the metal or come from nickel plated objects may be advantageous rather than objectionable, but manganese may cause trouble. These are some of the difficulties which may be encountered by using scrap material of unknown composition.

FOUNDRY EQUIPMENT

Engineered for maximum efficiency . . . lowest costs

IN THE General Electric foundry, Everett, Mass., is another Bartlett-Snow installation. Received from the mold, which is pushed onto the shakeout table with an air cylinder, the sand is reconditioned, revivified and delivered to the molders' hoppers at the exact and predetermined temper best suited to the work. Floor space is saved . . . efficiency increased. Lost molds are fewer . . . costs lower.

But one of many . . . the results secured in this plant are typical of those that accompany every Bartlett-Snow installation . . . nor are the advantages peculiar to big foundries or any particular type of work. Proportionate savings, equally impressive, have been made in the net operating figures in hundreds of small foundries where the problem was put up to Bartlett-Snow engineers . . . a privilege that is yours . . . no obligation.

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Art note: Touching up the mug

The Adventures of Bill

BY PAT DWYER

ALTHOUGH it is now too late to be of any practical benefit to me, I was interested recently in a newspaper article on the proper and modern method of bringing up children. The authoress, citing her own experience in proof of her statements, claims that the exercise of a little common sense and executive ability transforms the usual physical and nerve wrecking job into a peaceful and delightful occupation. Briefly, the entire secret lies in delegating certain duties to each of the children. These duties keep them so fully occupied that they have no time to fight, to tear their clothing, to stuff beans in their ears or noses, to get lost, to fall down stairs or into deep wells, to cut their fingers, stub their toes or get stung by irritable bees, to eat green apples or toadstools or to indulge in any other of the almost infinite list of activities which keeps the old fashioned mother on the dead run day and night.

According to the new method, household mechanics function as smoothly and silently as a $40 watch. No hurry, no rush, no overlapping, no tears, no shouting. A place for everything and everything in its place. Instead of working like a slave 19 hours per day and then doing a little light sentry duty by night, the mother can dispose of the day's work in a couple of hours. Then she is free to relax, indulge in the latest book, entertain visitors, keep up her club activities, go shopping and accompany her husband to places of amusement in the evening. She has ample time for setting up exercises, for beauty treatments, for the application of powder, stains and unguents, little things you might say, but absolutely indispensable in these modern days to the woman who wants to keep the marriage bond intact.

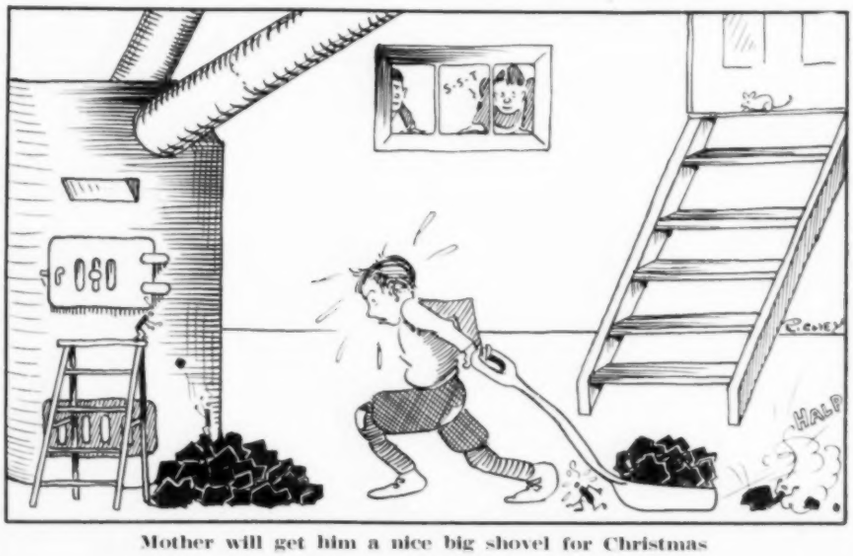
Certain masculine old fogies may scoff at the importance attached to these seeming trifles. Eyes of these sentimental old fossils grow misty when they rest upon stubby fingers that have gripped the oar along side their own in storm and sunshine over a period of many years. The same mist nullifies the attraction of vermillion nails drawn out to a fine point like the talons on the major carnivora. To one of these ancients, a glint of love light in a woman's eyes is a more potent charm than a face effectually concealed behind daubs of mascara, rouge and lipstick.

However, all that is by the way. The main point at issue is that under the new and improved dispensation, the mother is not run ragged in her efforts to roll the old household chariot along. She is not overwhelmed, swamped or smothered by the multiplicity of small duties incident to controlling the fiendish activities of a number of small children.

The lady who wrote the article gives full and explicit explanation of how she has solved the problem. She modestly admits that she is just a plain, ordinary person without any extraordinary or superhuman attributes. The method has lightened her work and given her many hours of freedom and she is quite confident that any person of ordinary intelligence can apply the method in her own home with equally satisfactory results.

She has four children, three girls and a boy ranging in age from nine years to three. She lists the duties allocated to each of the four and intimates that these duties may be combined in certain instances, or subdivided in other instances to meet the requirements of stable or stationary families as opposed to the more democratic type in which new members are admitted intermittently over a period of many years.

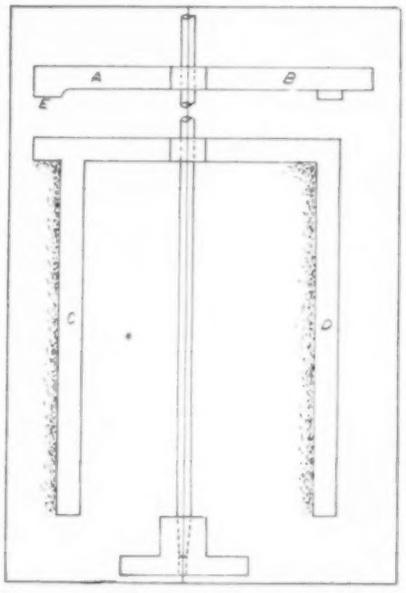
In the present instance Betty Jane, aged nine, makes the beds, dusts and sweeps upstairs and helps to prepare the breakfast. At noon she runs the vacuum cleaner over the downstair rugs and in the afternoon when she returns from school she runs all the errands, sprinkles the lawn and feeds the chickens. Samantha Sue, age seven, tidies up the bathroom in the morning, scrubs the kitchen floor and the front and back steps and washes the windows. She also attends to the wants of the canary and two pet rabbits. Ellen May who is five sets the table, washes the dishes, cleans the



Mother will get him a nice big shovel for Christmas

sink and carries out the garbage. On Monday she collects all the soiled clothing, loads the washing machine and sets it in motion. Since she is not yet of school age she has plenty of time to do the ironing, interview peddlers and other visitors at the front and back door and answer the telephone. Joe aged three is his mother's little man. He attends tne furnace, splits all the wood required for kindling and for the open grate and carries up from the cellar all the coal required for the kitchen stove.

"Apparently," Bill commented, when I had read him these particulars. "Apparently little Joe is destined to become a molder. He has the traditional qualifications, a weak head and a strong back. Which reminds me that I had an inquiry the



Four separate sweeps are employed

other day from a man who had an order for a cast iron receiver 30 inches diameter, 48 inches deep with a nozzle at one side near the open end. Only one casting was required, therefore he wanted advice on how to sweep the mold, or construct it otherwise at a minimum of patternmaking expense.

"Several methods are available for makings molds of this character. The method finally adopted in any given instance depends to a considerable extent on the ingenuity of the man in charge of the job and on the available equipment. The mold must be dried, therefore in the beginning two main options are presented, whether to make the mold in loam or dry sand. A loam mold is preferable since flasks are not an absolute necessity. However, I assumeed from the letter head and from the text that he was not familiar with loam molding, therefore I confined the description to a method of sweeping the mold in dry sand in a flask.

"The pattern equipment will include four sweeps as shown in the accompanying illustration, one flange, one half corebox for the large nozzle and another for the small nozzle on the opposite side. The present equipment probably includes boxes for making the 3-inch core and the 6-inch core.

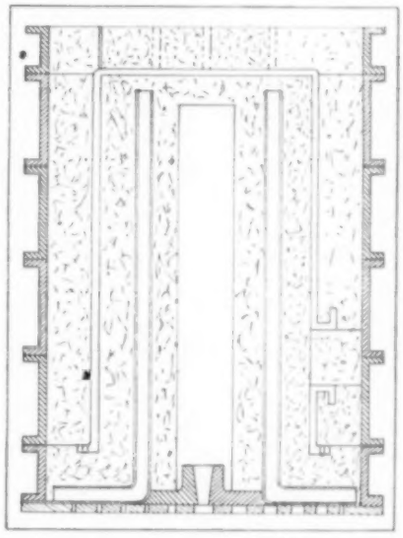
"The casting may be molded either open end up or open end down. The second method is the simpler of the two and will result in a perfectly satisfactory casting provided proper care is observed in gating and venting the mold. Provision must be made for easy and rapid escape of gas from the inside of the mold and the gates and runner must be absolutely clean and firm to prevent the formation of slush and dirt.

"The mold is made in three parts, a drag, a cheek and a cope, with the core or inside part of the mold standing on and forming an integral part of the drag. In the sequence of operation, the cope is rammed first, the cheek is rammed second, and the drag and core last. Proceeding step by step the operation may be described as follows: The bottom plate containing a large number of vent holes is leveled on the floor or on suitable blocks. The spindle socket is bolted in place in the center and the spindle is plumbed. This precaution is essential to facilitate lowering the cheek into place later during the assembly of the mold. The drag flask then is placed in position and partly filled with coke. The remainder of the space is filled with sand which is rammed in the usual manner to a height of about 1 inch above the face of the drag flask. Sweep *A*, Fig. 1, then is adjusted on the sweep arm so that the edge *E* touches lightly on the upper flange of the drag. By revolving this sweep the surplus sand is removed and a contour corresponding to the cope face of the casting is produced. The spindle and sweep are removed temporarily and the sand face is covered with parting sand. The cope is rammed over this face, removed, finished, blacked and made ready for the oven.

"An alternative method for forming this part of the mold is to saw a number of the boards of the desired thickness and shape and fasten them on a flat plate or bottom board provided with suitable guides for the cope. This method eliminates the use of sweep *A*.

"Assuming that the sweep has been employed as described, the next step is to remove the surplus sand from the face of the drag, either by turning the first sweep upside down, or, by the use of a straightedge resting on the flask flange. The cheek flask, made up of the necessary number of sections and corresponding to the height of the casting—plus shrinkage—between the lower flange and the lower side of the thickness just formed in the cope, then is lowered into position. An empty barrel, a section of pipe, a pulley ring, or any one of a combination of miscellaneous objects may be erected in the center to approximate the size and shape of the desired casting. The nozzle cores are adjusted in place by measurement and sand is rammed in the usual manner between this dummy and the wall of the flask. The dummy then is removed and sweep C is employed to remove the surplus sand and impart the desired contour to the cheek face. The cheek then is removed, finished, blacked and placed on the oven car.

"We now come to the most important part of the mold, the body of sand forming the interior. Sand and



Section through retort mold and core

coke are dug out of the drag at four equidistant points for the reception of long toes on the upright members designed to support and anchor the core, as shown in Fig. 2. Lengths of 4-inch steel pipe serve this purpose admirably. The toes rest on the bottom plate and the upper ends extend to a point within a few inches of the top of the core. With the pipes in place, sand again is rammed flush with the face of the drag. The sweep *B*, Fig. 1, is attached to the spindle and employed to sweep a seat for the flange at the mouth of the casting. The sweep is removed and a wood flange sawed in sections on the band saw is bedded in the depression. This method is preferable to forming the flange entirely with a projection on the lower end of the core sweep. The wood flange prevents sand from the core sweep falling into the cavity.

"As opposed to the former process where a dummy was employed in the center while ramming the sand in the cheek, a curbing or ring of some kind

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Criticizes Gray Iron Costs

(*Continued from page* 17)

offset the increased costs. I have had contact with many foundries. For several years the industrial research department, University of Pennsylvania, has collected, tabulated, and analyzed figures from foundries in the Philadelphia federal reserve district. The data requested have been monthly totals of production and shipments, and the total of unfilled orders and stocks of pig iron, scrap, and coke on hand at the end of each month. We have had great difficulty in securing even these data by the 23rd of the following month. I do not see how firms which have such difficulty in securing these few totals can handle the detail involved in the proposed cost system.

The required procedure under which every member of the industry must "be prepared to prove that his actual cost on any job was not more than his estimated cost" will work an unfair hardship on many foundries. It is a fact that no method of estimating is 100 per cent accurate. Granted the best of intentions, it is still impossible always to estimate exactly the time required for molding. Many factors outside the control of the management may increase the estimated costs. There are honest errors of calculation and of judgment which should not constitute a crime.

Subject to Fluctuations

The cost system proposes that "departmental costs and overhead rates be refigured and adjusted quarterly on the basis of the four quarters immediately preceding the date of adjustment." Also the method of determination of normal general overhead uses the ratio of the production in the four preceding quarters to the *normal* yearly production. These methods might be roughly satisfactory if the foundry industry were stable. The industry, however, actually is characterized by severe cyclical fluctuations because it is primarily a durable goods industry. The total quarterly production of 31 foundries in the Philadelphia federal reserve district is shown on the accompanying illustration. During the period since 1926 the industry in the Philadelphia area was chiefly influenced by the periods of general business activity and depression. A glance at the chart shows that nearly every estimate of production in the succeeding quarter based on the experience of the four previous quarters would have resulted in an overestimation or underestimation. It seems probable that flexible estimates based on general business activity would be more accurate than a fixed method of estimating based on the four preceding quarters. I suggest, therefore, that a budgetary system of control be recommended for adoption by the foundries. The estimates for the budget could be adjusted quarterly to conform to changes in the general business situation.

Another specific objection to the proposed uniform cost and estimating system arises from the fact that it has not always been nor will it always be to the advantage of gray iron foundrymen to charge prices sufficient to cover the fixed or non-variable general overhead. The statement has been made that "the greater part of general overhead expense, including such items as the fixed charges (taxes, insurance, and depreciation) administrative expense, and selling expense, remains fairly constant whether the foundry is operating at normal volume, or at only 25 or 50 per cent of normal." It is just as true that such costs are fairly constant even when the foundry is operating at capacity.

The proposed cost and estimating system is to be commended for recognizing that it is not always necessary to cover the entire fixed costs. It has already been pointed out, however, that the experience of the preceding four quarters is not a suitable basis for estimating costs. But the most serious criticism of this cost system arises from the fact that "normal production" has been defined as 55 per cent of capacity.

In the first place, reasoning from the Philadelphia situation, I challenge the accuracy of the estimate that during the period 1924-1931 "the gray iron foundry industry was operating at approximately 55 per cent of its maximum average operations during its best 6 consecutive months since Jan. 1, 1924." The inclusion of 1931 in the period called *normal* is debatable. But even when the average of 1924-1931 is used 55 per cent seems too low. Several years ago the industrial research department made a special survey of 14 foundries operating in Philadelphia. One measure of annual capacity which was used in the study was 12 times the maximum production in any month from 1923 to 1931. In the foundries studied the average ratio of production to capacity for the period 1924-1931 was 57 per cent. There has not been time to recompute the capacity used in this study to agree with the capacity as defined in the proposed cost system, but it is obvious that twice the production in the best 6 consecutive months will give a smaller capacity than 12 times the maximum month's production. A test was made on the records of 2 foundries. In one it was found that the capacity used for our study would have to be reduced 15 per cent and in the other 22 per cent to conform to the capacity defined by the proposed cost system. Making these adjustments to our ratio of production to capacity would result in an estimate of normal production for the period of 67 to 73 per cent. There is also a necessity for a further slight adjustment because of the fact that in some of the foundries the maximum month's production was in 1923 which would be excluded by the cost system.

But regardless of what percentage might be adopted by the code authority as the average *normal* for the industry, that average should not be imposed as a maximum. An average is a mere statistical tool which only indicates an approximate central tendency. It is obvious that there is considerable deviation from it both above and below. Thus, for example, in our study of only 14 foundries in Philadelphia the average ratio of production to capacity (our method) was 68.5 per cent in 1929 but the ratios for each firm ranged from 35 per cent to 85 per cent and half of the firms were above the average.

Penalize Certain Firms

The limiting of *normal* to the average of the industry penalizes those firms which are above the average. These firms would not be permitted to spread their overhead over their entire tonnage of output but would have to make part of their output bear the whole cost. Such a condition could result in an involuntary profit except for the fact that the firms operating below the average would only have to charge part of their overhead in their prices. In some cases this could actually result in the inefficient firm getting business at the expense of the efficient foundries.

The method of computing depreciation in the proposed uniform cost system has two provisions which will penalize the efficient, alert managements:

"The basis for depreciation shall be original cost, including freight and installation, except that in the case of plant and equipment acquired at an abnormally low price the basis shall be the fair replacement value of such assets."

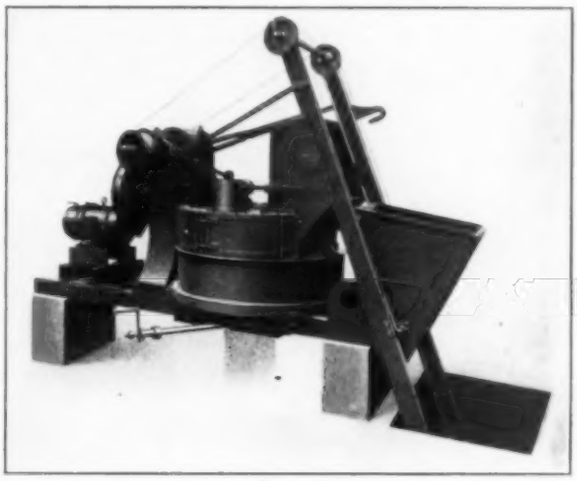
"The complete writing off of plant and equipment by the use of higher rates of depreciation or otherwise does not create an exemption from the calculation of depreciation for cost purposes."

Even in the halycon days of 1929 conservative accounting practice provided for valuation on the basis of cost or replacement whichever was lower. This system provides in effect, however, that valuation should be cost or replacement whichever is higher.

I do not know of any adequate survey of foundry equipment but it is my impression from visiting many foundries that most of the equipment

(*Concluded on page* 54)

The Scientific Way *to* Perfect Mixing



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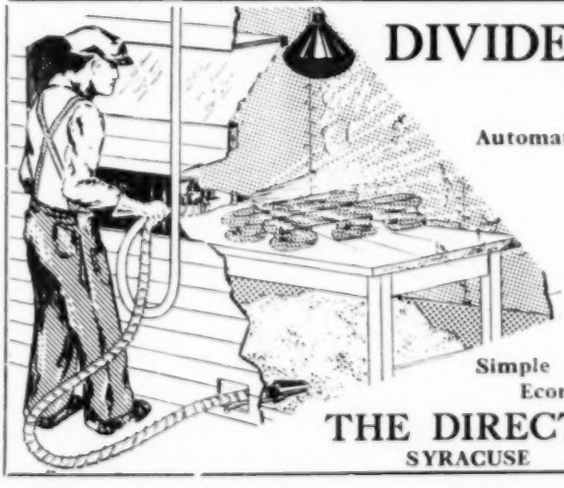

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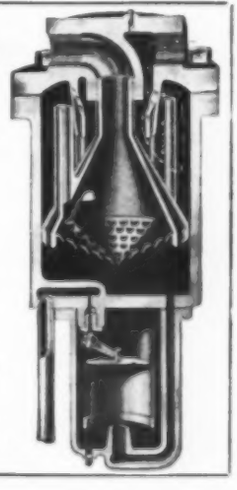

(*Concluded from page* 52)

is more than 10 years old. The cost system provides that all equipment should be charged off in 10 years. This proposal seems fair if at the end of the time there can be a reduction in cost.

Several years ago I visited a foundry which had an air compressor which had been taken from a scrap heap during the war. The engineer had repaired the compressor so that it gave good service at least through 1931. The original cost of this equipment must have been small, the original cost has probably been written off in the years since the war, but the ingenuity of the engineer and the sound accounting practice of the foundry would be nullified by the provisions of the proposed cost system. This foundry would not be permitted to quote lower prices even though its costs had been reduced by the efficiency of its management. Thus again the proposed cost system may place a premium on inefficiency.

The proposed cost system has classified a sales tax as a non-operating item. This item, however, should be regarded as part of the variable general overhead. Wherever the tax is a percentage of the sale price it should be added to the selling price of each job. Only the most naive assume that any manufacturer can or will assume a general sales tax.

Foundry Overhead Is Reduced To Minimum

By Edward Grant

Foundry Instructor, Kansas State College, Manhattan, Kansas

All foundries are supposed to show a general family resemblance, but the only foundry in Irving, Kansas is in a class by itself with practically no overhead either in the literal, or in the generally accepted sense. The town of Irving with a population of less than 500 is 40 miles from Manhattan on the highway running north to Lincoln, Neb. I have seen many a dilapidated rookery that served as a foundry, but this is the first foundry I have seen out in the open with the exception of a small shed 10 x 18 feet in which the smaller molds are made.

F. M. Oswalt, sole prop., is a machinist and blacksmith by trade. He uses a considerable number of castings in his business and formerly secured most of them from Leavenworth, Kan., 200 miles away. Finally he decided to erect his own foundry. He has operated it more or less continuously for the past 2 years.

Recently he called upon me to assist him in making a gas engine piston 14 inches diameter, total weight 600 pounds, a casting rather outside his usual range. We molded it one afternoon and poured it the following day in the presence of 40 interested Irving inhabitants.

The core was made in a skeleton corebox and dried one half at a time in the firebox of an old steam tractor pressed into service as a core oven. The mold was made in a hole in the ground. The blast for the cupola was carried 40 feet through a 5-inch pipe from a fan in the machine shop and entered the cupola through three 2½-inch diameter tuyeres

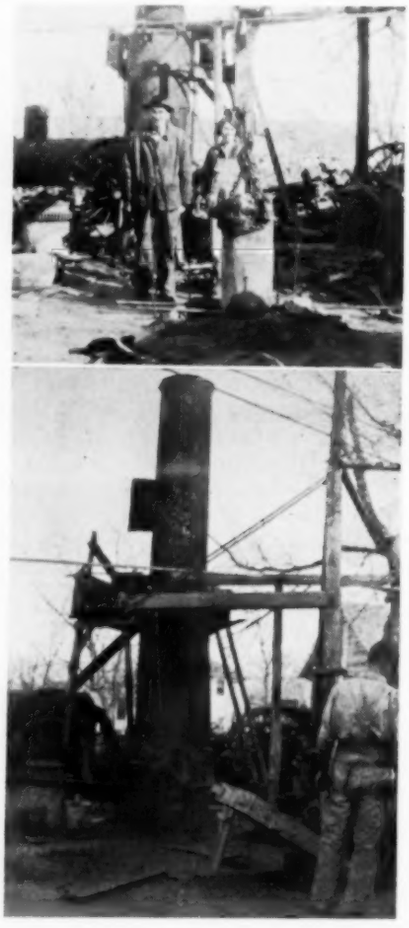

Fig. 1 (Above) — Piston casting above molding pit with cupola and emergency core oven in the background. Fig. 2 (Below)—Melting stock is thrown by hand from the ground to the charging platform of the out doors cupola

The proprietor has a method of his own for forming the sand bed in the cupola. He mixed a bucketfull of clay slurry, poured it in at the charging door, sprinkled some molding sand over the slurry and trusted to the heat from the coke bed to dry it. The cupola is out in the open and the material for the charge is pitched by hand from the ground to a small charging platform.

The resourceful Mr. Oswalt is somewhat of an inventor as well as a pioneer. He designed and built the rigging for boring large cylinders. The device is manipulated by hand through a train of gears. One certainly must admire the courage of a man who would undertake to run a foundry without foundry training and with no skilled help.

Mrs. Oswalt is a highly competent assistant. She is not burdened with household duties "having three grownup daughters suffering from the depression!"

She makes herself useful around the shop. She can run a drill, a lathe or a planer and in an emergency will take the single end of a 200-pound ladle and pour a mold.

All this away down south in Kansas, where the sunflowers bloom, the land of extremes and contrasts, where locusts eat the hay, where crocuses bloom in January and freeze to death in May!

Book Review

Control from the Top, by Francis Neilson, cloth, 190 pages 5 x 6½ inches, published by G. P. Putnam's Sons, New York, and supplied by THE FOUNDRY, Cleveland, for $1.50 and in Europe by the Penton Publishing Co. Ltd., Caxton House, Westminster, London.

It ought to be clear to anyone who will give the matter a little consideration, concludes the author, that man persists in showing after thousands of years of the vicissitudes of control from the top that there still are left in him traces of the aristocratic instinct of the individual, and that he, even now, will sometimes rebel against family, or friends, or bureaucrat, who would try to force him to act socially when he would prefer to make his own decisions.

The author has criticised in a most interesting manner three recent books, namely "The Industrial Discipline" by Dr. R. G. Tugwell, "The New Deal" by Stewart Chase, and "A Planned Society" by Mr. Soule. He has argued that these authors have not mastered the subjects they deal with in their books, and therefore it is not difficult to understand why their schemes so far put into practice have occasioned so much difficulty to industry. Support of the theory that what has been, and now is taking place is part of a plan to bring industry and finance under control and management of the government, can be found according to the author.

The book is well worth while for the thoughtful industrialist.

Plan Annual Meeting

The annual autumn meeting of the British Institute of Metals will be held in Manchester, England, Sept. 3 to 6 under the chairmanship of Dr. Harold Moore, president. A wide variety of papers on various subjects of nonferrous metallurgy will be presented at the technical session.

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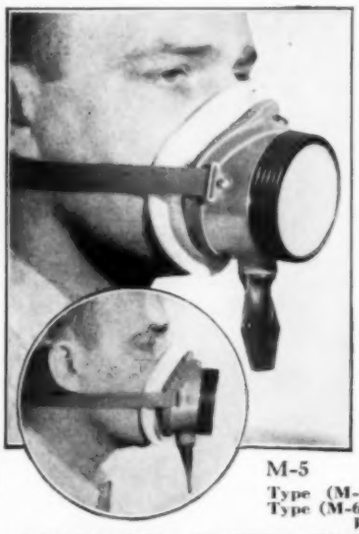

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LIQUID BINDER

Sweep Split Mold Off Centers

(*Continued from page 23*)

one method after the drag has been rammed full of sand and struck off level, an outline of the casting and splitting cores is marked on the surface. A cope is rammed on this face in the usual manner. The outline on the joint serves as a guide in setting the gates and risers. Position of gates and risers is shown in Fig. 3. A common pouring basin supplies metal to four gates, two on each side of a splitting core. Four large risers spaced equidistantly supply the necessary metal to compensate for shrinkage.

Where a cope with a complete set of bars is not available, a cope with a set of short jet or chuck bars will serve. The top of the mold is covered with cake cores and wedges are driven between the top of the cores and the bottom edges of the bars. Core covers, of course, also may be employed under a cope with a full set of bars. Lacking a cope of any kind, the covering cores may be held down with a covering plate in one piece or in two or more sections. In many instances a flask ring or other ring may be placed in the center, thus doing away with the necessity of handling a great quantity of sand. Many of these features are shown in the composite plan view of the assembled mold Fig. 3.

Bind the Mold

Where a bottom plate or binders extend under the bottom of the mold, the mold may be clamped by the flask flanges or may be secured by bolts extending through binder bars on the top. In an alternative method, weights resting on rails or cast iron binders, may be employed to hold the various parts of the mold together.

In a shop where the facilities are available, a mold of this kind readily may be struck up in loan. Even where no plates of the right size are in existence, one for the bottom and one for the top easily are made and add little to the cost of the job. After they have served their purpose they may be broken and added to the iron stock pile, or, they may be placed in reserve for another job.

The bottom or foundation plate presents a plain surface while the surface of the top or cope plate is covered with short projections known as *dabbers*. This surface feature prevents the loam coating from falling off when the plate is inverted. Good practice and an eye to the future suggests placing several openings in the cope plate in addition to those required for the first job. Plan and sectional views of a cover plate are shown in Fig. 5.

A cross section of the closed mold rammed in a pit in the floor, is shown in Fig. 6. A pit is not required where suitable curbing is available. In an emergency a ring of heavy weights might be utilized to retain the sand outside the brick wall, but usually a steel or cast iron curbing ring is employed. The steel ring may be in two or more sections held together by bolts or cotter pins. The cast iron curb is made in short sections with male and female hinged joints at the ends and may be assembled readily into circles of varying diameter. Runner and riser basins preferably are made up before the cope plate is lowered into place.

A spindle socket for the second or eccentric block method of sweeping two half molds together is shown in Fig. 7. The base plate 2 feet in diameter and from 1 to 1½ inches thick is provided with four lugs to facilitate removal from place to place, and with a hub in the center 12 inches in diameter and 6 inches high. The center of the hub is taper bored to fit the base of the spindle, usually between 3 and 4 inches.

The small slot about 1-inch deep and the same width shown at *A* receives a lug screwed to the spindle and prevents the spindle from moving in the socket. The same purpose might be served by a square spindle or by a round spindle with a square base fitting into a socket of similar shape. However, it is apparently idle to speculate on the adoption of a square spindle, so long as the round steel shaft or pipe is more readily available. Also a digression into the various types of spindles and their application would lead too far afield from the present description of making a mold with a fixed spindle and a revolving arm.

A slot ⅜-inch deep and ¾-inch wide extends from the top to the bottom of the spindle on two diametrically opposite sides and with the centers 90 degrees distant from the center line of the lug which fits in slot *A* Fig. 7. These features are shown in detail in Fig. 9. The distinctive device in this sweeping ensemble, the eccentric block, is keyed to the spindle by these slots, first on one side and then on the other.

The weight of this block, the arm and sweep board or pattern segment, also the bearing down effort of the molder in pulling the sweep around, are supported by a collar shown in Fig. 8 and at *C* in Fig. 12. Usually this collar is mild steel, but in many instances a cast iron collar will serve satisfactorily. It is bored out to a free sliding fit over the spindle, and is attached by three set screws to the spindle at the desired point.

With the spindle set up plumb and with the collar in place, the eccentric block Fig. 10 is lowered into place. The slot in the bore coincides with one of the long slots in the spindle. The key shown in Fig. 10 is driven into the square opening to hold the eccentric block definitely in place until one half of the mold is swept. Then the block is shifted to the opposite side of the shaft and attached in a similar manner. The set screw shown at *S* in Figs. 10 and 12 helps to hold the eccentric block in place.

Bored to Fit Block

The collar of the sweep arm Fig. 11 is bored to fit easily over the eccentric block and *not* over the spindle, as in ordinary practice. The straight part of the arm is pierced with many vertical and horizontal openings through which the sweep board or pattern may be adjusted and bolted in place. The complete assembly is shown in Fig. 12 where *A* is the socket, *B* is the spindle, *C* is the collar, *D* the eccentric block, *E* the key for holding the eccentric block in place and *F* the collar and sweep arm to which the sweep board or pattern may be attached.

No hard and fast rule applies to the sizes of the eccentric block, with one exception. The distance between the center of the spindle opening and the center of the eccentric block is equal to half the thickness of the splitting core to be employed. This feature is illustrated in Fig. 15, a composite view of the eccentric in the two positions it will occupy. Assuming the use of a 4-inch spindle and a 4-inch thick splitting core, the center of the eccentric block is found 2 inches from the center of the spindle, or in other words, on the circumferential line of the spindle. Thus while the center of the spindle is *A*, the collar of the sweep arm revolves around the eccentric in which the center is *B* for the first half of the mold, and *C* for the second half.

One advantage of the eccentric block is that it is above the surface of the mold and therefore affords a better opportunity of drawing center or guide lines with straight-edge or plumb bob.

An application of the eccentric block method to the production of a split fly wheel is shown in Fig. 13. Other equipment for making the mold included five core boxes for the splitting core, hub core, hub cover core, arm core and outside rim core. The rim cores lend themselves readily to production on a plain jolt molding machine.

Machining allowance is provided on adjoining ends of these castings. Also any lugs or flanges designed for bolting the ends together are provided for in the arm corebox where suitable loose pieces are screwed or doweled in place.

The mold shown in Figs. 13 and 14 is built on a loam plate and covered with a second loam plate. However, a green sand, skin dried or dry sand bed would serve the same purpose. Also,

(*Concluded on page 59*)

ADVERTISING PAGES REMOVED

(*Continued from page* 56)

any one of the various types of copes previously described might be placed on this mold. The exposed surface top or bottom is slight. The best method is the one best suited to local conditions.

Removes Dust At the Shakeout

(*Concluded from page* 21)

into the secondary collector located below the fan. The blast from the fan is carried down to the blast side of the shakeout and under the floor to the other side where it supplies the wind for the blast around the edge of the suction funnel. The blast pipe is carried up and connected to a low-velocity dust collector system. This is done to prevent the blast from becoming contaminated with fine dust particles since the fan is used for both suction and blast.

The low velocity system includes a bag-type dust collector located outside the building and gathers particles from various points of the sand handling system where dust formerly was created. The core knockout also is connected to this system, two 10-inch suction pipes being located at the rear of the knockout cabinet and directly back of the vibrator. A steel hopper below the cabinet collects burned sand cores and casting. The sand is wet down and castings raked out.

Small castings are tumbled while still connected to the gates in a large steel water tumbler.

A stationary vacuum turbine system is piped to convenient points about the plant. Floors are cleaned by vacuum and are sprinkled when necessary to be swept by broom. Walls, beams and other overhead points where dust may collect are brushed and cleaned with vacuum attachments.

J. R. Allan and Frank H. Amos, 415 South Euclid avenue, Chicago, developed some of the interesting features employed in this installation.

Book Review

Alloys of Iron and Tungsten, by J. L. Gregg, cloth, 511 pages, 6 x 9 inches, published for the Engineering Foundation by the McGraw-Hill Book Co., New York, and supplied by THE FOUNDRY, Cleveland, for $6.00 plus 15 cents postage, and in Europe by the Penton Publishing Co. Ltd., London.

This volume, the third of the Alloys of Iron Research monograph series, presents a comprehensive review and a critical appraisal of the known facts on the alloys of iron and tungsten, and the effect of tungsten on cast iron and steel, including high-speed and other tungstetn tool steels. The monograph was prepared by the Battelle Memorial institute as a part of its contribution to the Alloys of Iron Research. Previous publications include *The Alloys of Iron and Molybdenum* and *The Alloys of Iron and Silicon*.

The foundryman, engineer, steelworks metallurgist, superintendent and melter will find in this book the available data on cast iron and steel containing tungsten. Information is presented on the ores and their reduction, manufacture, structure, properties and use of tungsten steels including magnet and die steels, tungsten corrosion and heat-resisting alloys, and a concise but complete discussion of the manufacture, mechanical properties, cutting performance, and uses of high-speed and other tungsten tool steels.

The first chapter is devoted to the history and development of tungsten alloys. This is followed by information on the constitution of iron-tungstetn alloys, preparation and properties of iron-tungsten alloys, iron-carbon and tungsten-carbon alloys, the manufacture and characteristics of tungsten steels, tungsten in cast iron and steel, tungsten in tool and die steels, high-speed steels, and miscellaneous alloys containing tungsten. The work presents a complete resume of all previous works on the simple and complex alloys of iron and tungsten complete to July 1, 1933.

Casts Bronze Chain In Core Molds

(*Concluded from page* 25)

cavities *G G G* serve as receptacles for the precast links while the vertical cavities *L L* receive the molten bronze for the conecting links..

Progressive steps in assembling the four cores for any given mold unit are shown in Figs. 2, 3 and 4. Fig 2 the four cores are shown as they leave the oven. In Fig. 3, left, core *B* has been inverted endways and placed on core *D*. Core *C* has been inverted in a similar maner and placed on top of core *E* as shown to the right in Fig. 3 Each of these pairs of cores is pasted on the joint to facilitate handling.

In the next step core *CE* is turned face up as shown at the right Fig. 4 and the precast links are placed in the cavities *G G G*. Core *BD* then is turned face *down* and placed on top of core *CE* as shown to the left in Fig. 4. A sufficient number of cores may be arranged in line to form a complete chain, or only part of a chain from any given heat. The end link of a partly completed chain may be placed in the end unit of a new core set-up and completed during the following heat.

At the plant of the Alliance Brass & Bronze Co., a simplified and highly efficacious method has been developed for gating tablet castings. Instead of the usual thin branch gates at the sides or ends, a number of small pencil gates are placed directly on top and approximately at the center of the casting. These gates are formed in a split block core which is placed on the pattern and rammed up with the cope The core is tapered at the sides and ends, is shaped somewhat like the letter *T* and thus is gripped firmly by the sand in the cope.

The cope face of a mold with one of these cores in place is shown at the left in Fig. 6. The two black marks on either side are for bosses by which the tablet is attached to the foundation. The series of small black dots around the edge of the mold impression are vent or small riser openings and are pierced with a small rod after the cope is lifted from the drag.

Design of the corebox with one side and one end removed for a clearer view is shown in Fig. 7. This box forms a half core. Two halves are pasted face to face to form the complete core. Metal is poured in to the tapered pouring cup *K* and is conducted through the sprue *M* into the horizontal runner *N* and thence through the small pencil gates *X* into the mold.

Nonferrous Group Will Meet in Chicago

Nonferrous Foundry Association for Industrial Recovery will hold its annual meeting at the Hotel Bismark, Chicago, Sept. 19 to 20. Special sessions will be devoted to such subjects as standard classification of castings as to intricacy and weight, standard terms of payment, standard cost accounting and trade customs. Sam Tour, 47 Fulton street, New York, is executive secretary of the association.

A.S.M.E. Nominates

R. E. Flanders, president, Jones & Lamson Machine Co., Springfield, Vt., recently was nominated for president of the American Society of Mechanical Engineers. Other nominations are as follows: Vice Presidents—E. W. O'Brien, W. R. C. Smith Publishing Co., Atlanta, Ga.; James H. Herron, James H. Herron Co., Cleveland; H. R. Westcott, Westcott & Mapes, Inc., New Haven, Conn.; Managers—B. M. Brigman, University of Louisville, Louisville Ky.; Alfred Iddles United Engineers & Constructors Inc. Philadelphia; J. W. Haney, University of Nebraska, Lincoln, Nebr.

Total production of steel castings in 1933, according to a recent report of the American Iron & Steel institute, was 338,061 tons as compared with 216,760 tons in 1932.

European Foundry Practice

Digest of recent literature covering various phases of castings manufacture

Effect of Chilling

Anomalies in the Chilling of Cast Irons; Influence of Oxidation. (Les Anomalies de Trempe des Fontes; Influence de l'Oxydation) by Auguste Le Thomas. *La Fonte*, bulletin of the French center of foundry research, Paris, October-December, 1933.

The author has investigated the influence of oxidation on cast iron, and has found that action goes a long way to explain why irons of the same chemical composition and used under identical conditions have varying physical and mechanical properties. These experiments further show that quality of an iron required to give sound castings is in direct relation to the anomalies noticeable in the aptitude of cast iron to chill. This tendency to chill can be tested easily.

The author has devised a test piece in the form of a small parallelepipede, which is cast in a sand mold, but with one side against a heavy cast iron block. The degree of chill can be determined by breaking the bar at the center. A notch is provided for that purpose. Experience has shown that the characteristics required from the iron for certain given castings are in relation to the thickness of the chill. Practice shows that a certain factor, which is not well known, has an influence on the aptitude of cast iron to chill. An example is described in which a bath of foundry iron is kept at a temperature ranging from 1300 to 1400 degrees Cent. in contact with the atmosphere, it being found that the aptitude to chill increases to such a point that after 2 or 3 hours the iron will give test pieces that are completely chilled, although chemical analysis shows no appreciable change in the composition which can be explained by heat losses. On the other hand, if the bath is protected from contact with the atmosphere, there is no increase in the chilling.

Finally, if after contact with the atmosphere, which has given an increase in chilling, the bath is deoxidized, the increased chill disappears. The author also has ascertained that ingots of iron that have acquired a propensity to chill through heating in contact with the atmosphere will preserve that property when remelted. The amount of chill remains the same, as do physical and mechanical properties. Experiments show these conclusions the same whichever kind of furnace was used.

The author comes to the following conclusions: (1) An iron of a given composition has a propensity to chill which depends on the conditions under which it was melted, and variations are in relation to the state of oxidation or deoxidation of the bath, independent of the temperature up to 1400 degrees; (2) Tendency to chill has its minimum value when the iron has been deoxidized properly; (3) Generally speaking, foundry irons have an aptitude to chill which is above the minimum value obtained when the bath has been deoxidized completely. This constitutes an anomaly of the chilling property, which is independent of the chemical composition, but which is related to conditions of oxidation of iron in the liquid state. This anomaly repeats itself when the iron is remelted, if it has not been deoxidized. When the anomaly of chilling increases in value, castability decreases. From a practical point of view, the author states: (1) From the standpoint of researches concerning pig iron, many investigations have been made in which additions have been made to the bath, and their results have been inconclusive or irregular, and it is believed that these divergent results are due to the phenomenon described as the anomaly of chilling; (2) From the point of view of foundry practice, the use of furnaces that have an oxidizing atmosphere tends to give irons abnormally chilled. In a cupola properly controlled there should be no anomaly, except in cases where the raw materials are unsatisfactory or where the blowing of air in the cupola is not properly conducted.

It is not the high value of the chilling effect itself that is dangerous, but this high value is an indication of other disorders, which react on the qualities of the iron. Such abnormal chilling effects are accompanied by a decrease of castability, variations of the properties of the iron, resulting from differences of thickness, and a tendency to porosity in massive sections.

The measure of the degree of chilling of an iron in comparison with a test piece taken from the same iron, which has been deoxidized, is the method of control that is recommended.

High Grade Irons

New Developments in Improving Cast Iron; by Dr. F. Kundt, *Die Metallboerse*, Berlin, June 2, 1934.

Constructional engineering requires increasing amounts of higher grade cast irons. Such gray iron types not only are indispensable for various machine parts which require high physical properties with good machinability, such as base plates of electric motors, elevators, ventilation equipment, etc., but also for heating and hot water supply equipment. This covers castings which have to resist higher temperatures for many years, especially grate bars, furnace doors and the like. For the manufacture of such heat resisting parts, alloys such as chromium and molybdenum are used, these metals having a most favorable influence, in quantities under 1 per cent, on the quality of cast iron.

If there are no particularly drastic requirements for heat resistance of cast iron parts, as for example, in grate bars and parts of stationary boiler equipment, additions of 0.6 per cent chromium and 0.3 per cent molybdenum suffice. To obtain such an alloy, a calculated quantity of powdered ferrochrome with 65 per cent chromium and 6.5 per cent carbon and 5 to 8 per cent silicon, as well as powdered ferromolybdenum with about 70 per cent molybdenum and maximum 1 per cent carbon is used. The calculated quantity of ferrochrome and ferromolybdenum are mixed and packed in small paper sacks which are added gradually to the ladle during tapping. The iron should have a rather high temperature before and during tapping. The slag cover floating on the liquid iron

(*Concluded on page* 62)

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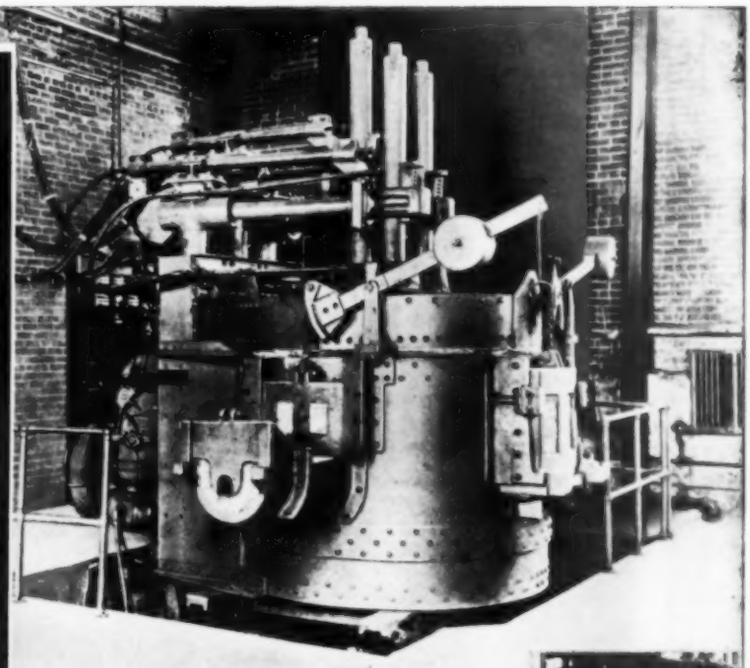

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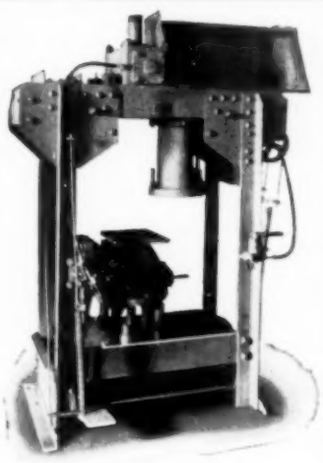
Specialties



Cores for the above castings are being made universally on our machines, resulting in greatly increased production and better cores.

We have a machine for your job.

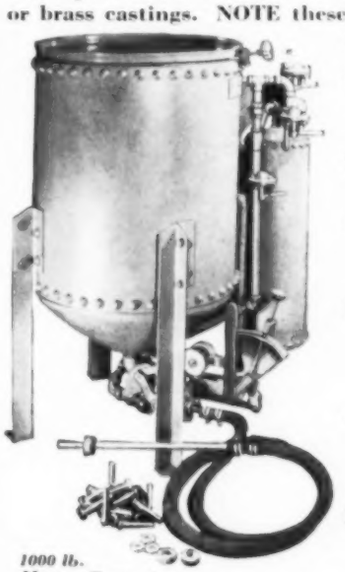
Your Correspondence Solicited

Wm. Demmler & Bros.

Kewanee, Illinois

The RUEMELIN SAND BLAST GENERATOR

is the perfected blast machine for cleaning iron, steel or brass castings. NOTE these important operating features:



1000 lb. Master Generator

Fastest cleaning action.

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Simplest to operate.

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Quick accessibility to all parts.

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Rubber Sand Valves assure lowest maintenance cost.

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Automatic Mixer handles steel grit-sand-shot.

* * *

Made in many sizes to 2000 pound Sand capacity.

Write for catalogs and prices on cabinets, suction guns, cloth bag dust collectors

RUEMELIN MFG. CO.

1587 S. First St. - Milwaukee, Wis.

(*Concluded from page 60*)

should be pushed aside when adding the small paper sacks. In many cases an addition of molybdenum alone is sufficient and the necessary quantity can be added in the form of ferromolybdenum without fear of losses.

Experience has shown that grate bars with 0.6 per cent chromium and 0.3 per cent molybdenum have a life twice and three times as long as those of ordinary unalloyed cast iron. It is evident that because of the longer life and the elimination of disturbances in operation by changing bars which have become unusable, the slight addition in cost of the alloyed material is well justified. The extraordinary influence of the additions of chromium and molybdenum on the quality of the cast iron is evident by the fact that with a content of 20 per cent chromium and up to 2 per cent molybdenum, the cast iron is resistant to temperatures up to 1200 degrees Cent. and also to the attack of hot sulphuric acid. In cupola operations such high percentage castings cannot be produced, and it is practical to use a crucible furnace heated with oil, in which a preliminary melting with high chromium and molybdenum contents is made which is then mixed together with the liquid cupola iron.

Low Carbon Iron

Experiments Relative to the Production of Low-Carbon High-Duty Cast Iron (Experiences Relatives a la Production des Fontes a Resistance Elevee a bass Carbone by Dr. Vittore Palcietti. *Industria Meccanica*. No. 11, 1933, translated in *La Revue de Fonderie Moderne*, Paris, April 10, 1934.

High-duty cast-iron generally attains a tensile strength ranging between 28 and 32 Kilograms per square millimeter (39,824 to 45,515 pounds per square inch). It is constituted by ferrite and cementite in eutectic proportions, and as small a percentage as possible of free graphite evenly distributed.

Various methods have been patented to obtain such an iron. The author has conducted experiments showing that it is possible to obtain a low-carbon high-duty iron in the cupola, at relatively low cost.

In the first experiment the charge consisted of: 14 kilograms of ferrosilicon at 23 per cent; 79 kilograms of steel scrap; 7 kilograms of ferro-manganese at 7 per cent. The analysis was: total carbon, 0.30 per cent; silicon, 3.22 per cent; manganese, 1.01 per cent. Castings of various thicknesses were obtained, both in green and dry sand molds. The analysis of the castings gave: graphite, 2.02 per cent; combined carbon, 0.88 per cent; silicon, 2.93 per cent; manganese, 0.73 per cent; phosphorus, 0.10 per cent; sulphur, 0.15 per cent. The tensile strength was 32.4 kilograms per square millimeter; the structure was pearlitic and the castings sound.

In a second experiment the charge was composed of 9.75 kilograms of ferrosilicon at 23 per cent; 86.25 kilograms of steel scrap; 9 kilograms of ferromanganese at 10 per cent, and 45 kilograms of scrap coming from the first charge. The results were also good. In a third experiment the charge was similar to that of the first test, but the distance between the hearth and the tuyeres in the cupola was reduced to decrease the percentage of total carbon. The results were interesting, but the castings were thin, and those with thick sections showed defects.

In a fourth experiment the proportion of steel scrap in the charge was made up of the cheapest scrap possible; the results were quite good. A comparison of costs showed that the cost of producing the low-carbon high-duty iron was actually less than the cost of producing ordinary machinery castings.

Making Road Blocks

Road-Sett Foundry of the Stanton Iron Works Co., Ltd., by Percy Fox-Allin, the *Foundry Trade Journal*, London, April 19, 1934.

That company recently completed a contract for casting road setts for flooring the Mersey tunnel, the job requiring approximately half a million castings. The process used for hardening the road sett studs consists of casting against a special form of metal chill which has been treated previously with sulphur or a sulphur compound. The parts of the mold not to be treated are covered over by a templet which leaves the chill sections exposed. The sulphur compound is sprayed on the chill surface with compressed air. The templet is removed and the treated chill then is placed in the casting mold, sand is rammed into the mold, which then is assembled ready for casting.

A section of the plant, arranged especially for casting the sets, is described in the article.

Light Alloys

Fluidity and Castability of Ultra-Light Alloys (Fluidite et Coulabilite d'Alliages Ultra-legers; from an article by Luigi-Losana in *Revue di Alumino. La Fonderie Belge*, Liege, March-April, 1934.

After explaining the difference between fluidity, or viscosity, and castability, and describing the apparatus used in his experiments, the author arrives at several conclusions. Castability of five light alloys was studied. These alloys were composed of manganese, aluminum and zinc, and were of the following compositions: Alloy A, manganese 92 per cent; aluminum 5 per cent; zinc 2.5 per cent. Alloy B, manganese 90 per cent; aluminum 6 per cent; zinc 2.6 per cent. Alloy C, manganese 87 per cent; aluminum 10 per cent; zinc 2.5 per cent. Alloy D, manganese 82 per cent; aluminum 15 per cent; zinc 2.7 per cent. Alloy E, manganese 83 per cent; aluminum 10.7 per cent; zinc; zinc 5.7 per cent.

In every case, fluidity increases with temperature, but not along a straight line. Fluidity at a given temperature increases with the content of aluminum. Castability first increases with temperature, and then, when melting in the open, decreases from a certain temperature onward, owing to oxidation. When melting in an atmosphere of hydrogen, castability is a linear function of the temperature.

In the second experiments, aluminum-manganese alloys were investigated, and it was seen that measurements of fluidity show a maximum at about 50 per cent of manganese, and this maximum is all the more marked when the temperature is lowest. Measurements effected on castability show the same conclusions, which indicates that there is a relation between castability and viscosity.

For a given alloy at a given temperature, castability increases with the temperature of the mold and follows a law that can be represented by an hyperbolic curve.

Book Review

German-English Dictionary of Metallurgical Terms (Deutsch-Englisches Fachwoertenbuch der Metallurgie), by Henry Freeman, fabrikoid, 327 pages, 5 x 7 inches, published by Otto Spamer Verlag, G. m. b. H., Leipzig, Germany, and supplied by THE FOUNDRY, Cleveland, and in Europe by the Penton Publishing Co. Ltd., 416-17 Caxton House, Westminster, London.

Those who have occasion to consult technical German publications, and have difficulty in translating some of the terms encountered will find this distionary of considerable value. In his foreword the author states that in preparing the dictionary he consulted numerous catalogs, technical publications, and dictionaries, so that the English translations of German terms would be as exact as possible. He is to be congratulated on his efforts. While in many instances the work could be abridged considerably through elimination of terms that almost have an exact English counterpart, for example, terminations of chemical compounds, it detracts little from the worth of the dictionary.

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DIAMOND

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Sand Blast Sand

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WASHED, DRIED AND SCREENED SPECIAL SANDS FOR STEEL MOULDING, FURNACE BOTTOMS, CORES, OPENERS,—AND SILICA FLOUR

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You may properly expect precise, thoughtful service . . . and a cuisine that is one of the enduring traditions of this world-famous hotel.

BELLEVUE STRATFORD

HANNA PIG IRON

—dependable uniformity

BRANDS:
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The HANNA FURNACE CORP.
MERCHANT PIG IRON DIVISION
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Obituary

ROBERT F. RINGLE, 49, works manager, Herman Pneumatic Machine Co., Pittsburgh, died at his home in Zelienople, Pa., on July 26. Mr. Ringle was born in Derry, Pa., in 1885. He became an apprentice with the Westinghouse Air Brake Co., Wilmerding, Pa., in 1901, and continued his connection with that company until 1908. After spending 2 years with the Mesta Machine Co., he entered the employ of the Herman Pneumatic Machine Co. in 1910 as an engineer. A year later he was made chief engineer and in 1913 was promoted to works manager. Mr. Ringle was an inventor of note and had a wide acquaintanceship throughout the foundry industry, both in this country and abroad.

♦ ♦ ♦

William Mitchell McCoy, comptroller of the American Brake Shoe & Foundry Co., New York, died recently at his home.

♦ ♦ ♦

Galvin R. M. Wilcox, 85, founder and former president of the Coldwell-Wilcox Foundry Co., Newburgh, N. Y., died recently.

♦ ♦ ♦

Edmund K. Swigart, 67, senior vice president of the Bucyrus-Erie Co., South Milwaukee, Wis., died July 7 while on a trip to the north Wisconsin woods.

♦ ♦ ♦

H. C. Hanson, founder and president of the American Gas Machine Co., Albert Lea, Minn., died recently while on an automobile trip in northern Minnesota.

♦ ♦ ♦

Valentine Seeger, 79, founder, Toledo Brass & Iron Works, Toledo, died July 7 at his home. Mr. Seeger came from Germany 63 years ago and 10 years later founded his own company.

♦ ♦ ♦

Frank Tillman, incorporator and member of the board of directors of the Industrial Steel Casting Co., died July 12. Mr. Tillman had been a director of the firm since its organization, and was particularly active in sales promotion work.

♦ ♦ ♦

W. J. Simanek, 52, president of the Racine Pattern Works, Racine, Wis., died July 5. After being connected with the pattern department of the J. I. Case Co., Racine, for several years he became superintendent of the pattern shops of the old Mitchell Motor Co., but resigned in 1913 to establish his own shop.

♦ ♦ ♦

Thomas Leslie Wilson, 41, a partner in Bauer-Wilson & Co., Chicago, pig iron and coke dealers, died July 26 at his home in Momence, Ill. Mr. Wilson was born in Evansville, Ind., and was graduated from the University of Wisconsin in 1914. He then became superintendent of the open-hearth department of the Illinois Steel Co., and later was associated with Hickman, Williams & Co., and Walter-Wallingford Co., Chicago.

♦ ♦ ♦

William Hastings Bassett, 66, metallurgical manager, American Brass Co., Waterbury, Conn., and recently elected president of American Society for Testing Materials, died at his home in Cheshire, Conn., July 21. After being graduated from the Massachusetts Institute of Technology in 1891, he became chemist with the Popes Island Mfg. Co., New Bedford, Mass. Later he became superintendent and remained with that company for 5 years. He then accepted a position as teacher of chemistry at Swain Free school, New Bedford, and remained there until 1900 when he became associated with the New Jersey Zinc Co. as chief chemist at their Newark, N. J., works. In March, 1902, he was made chemist for the Coe Brass Mfg. Co. and in 1903 was made chief chemist and metallurgist of the American Brass Co. In 1912 he was made technical superintendent and metallurgist and in 1930 he became metallurgical manager.

He pioneered in the application of the spectroscope to routine work in the nonferrous metals industry and in the application of the microscope to the metallography of nonferrous metals. In 1930 he served as president of the American Institute of Mining and Metallurgical Engineers, and for years had been an active member of technical societies in this country and abroad.

The Adventures of Bill

(*Concluded from page* 51)

is erected on the drag, in which to ram the sand for the core. This ring is slightly larger in diameter than the diameter of the finished core. A long plug, or a short plug pulled up with each successive ramming, is placed in the center to form a vent opening in the core. When the sand has been rammed to the desired height, the plug and outside ring are removed. The spindle is replaced and the sweep *D* is employed to impart the desired contour to the core.

"The spindle and sweep then are removed for the last time. The opening in the center of the core either is filled with coke up to a point 3 or 4 inches below the top, or, a piece of wire screen is placed at the same point and sand is packed on top and slicked off flush with the upper surface of the core. This part of the mold then is finished, blacked and placed in the oven.

"After the mold parts have dried, the center cores are placed in the nozzles with a clearance of ⅛-inch at the ends near the main core. One end is held in place by the print and the other end is secured by chaplets. In some instances where the cheek is parted above the nozzle, or where there is a hole in the flask, it is possible to move the nozzle center core forward and jam it against the main core after the cheek has been closed down. This eliminates the usual fin at this point. The casting is poured through a ring of small pop gates set directly above the vertical wall of the mold.

"An illustrated description of a method for molding castings of this character in the opposite position, that is mouth up, appeared in THE FOUNDRY, July 1, 1931.

Organize Unit of Nonferrous Association

Officers were elected and committees named at the organization meeting of the metropolitan unit of the Nonferrous Foundry Association for Industrial Recovery held in New York, Aug. 1. The program of the association was discussed preparatory to the annual meeting of the national organization in Chicago, Sept. 19 to 20.

Temporary officers of the metropolitan unit elected were: B. Tamaroff, Trojan Founders Inc., Brooklyn, chairman; F. H. Landolt, Penn Brass & Bronze Works Inc., Brooklyn, vice chairman; and B. M. Friedman, Bronx Brass Foundry Inc., New York, secretary. These officers together with P. H. Halloran, Halloran's Brass Foundry, Astoria, L. I., Charles A. Martin, Wilmer Bronze Foundry, Brooklyn, and Eugene Fiamma, World Brass Foundry, also were elected as members of the executive committee.

The program for a uniform cost estimating system and uniform classification of miscellaneous castings as to weight and intricacy was discussed and a committee named to act on both of these projects. These plans will be passed upon at the national meeting in Chicago. The committee consists of F. H. Landolt, C. Luppy of the Bliss Foundry, Long Island City, B. M. Friedman, B. Tamaroff, Mr. Fortomaroff of the Manhattan Foundry & Model Co., New York, Eugene Fiamma, P. H. Halloran, and Jacob Safer of the Brass Foundry Corp., Brooklyn.

The meeting voted upon and adopted by resolution uniform terms of payment of 1 per cent for 10 days and net for 30 days. About 25 foundries were represented at the meeting, which was adjourned without definitely setting a time for the next session. However, it is expected that another meeting will be held shortly prior to the national convention in Chicago. Sam Tour, executive secretary of the national association, presided as chairman.

Better Tumbling AT Lower Cost

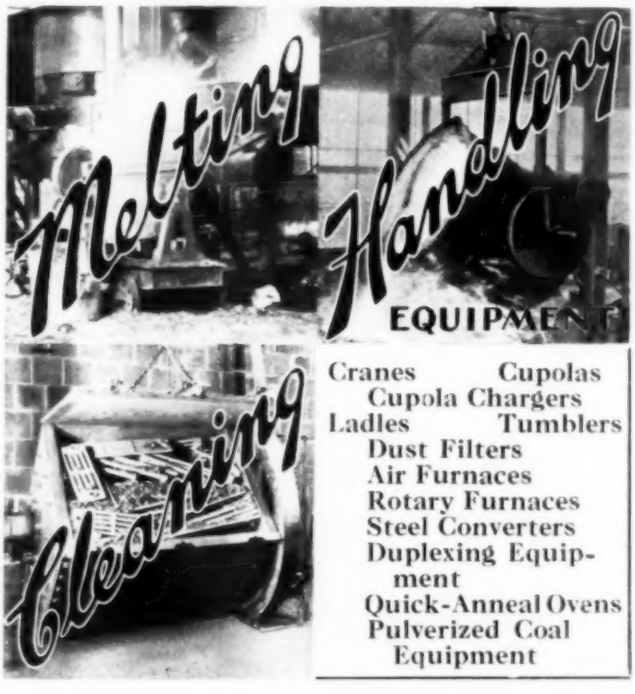
Reason No. 4

When tumbling is completed, direction of rotation is reversed, stars return automatically to end sections. Then door of tumbling section is opened and work discharged. That's quicker and cheaper than picking it from the stars.

There are five other reasons for your looking into this barrel further. May we send them to you in a letter?

N. Ransohoff, Inc.
West 71st St., at Millcreek,
Carthage, Cincinnati, O.

New IDEAL Side-Loading Star Return Barrel.



Cranes — Cupolas
Cupola Chargers
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Dust Filters
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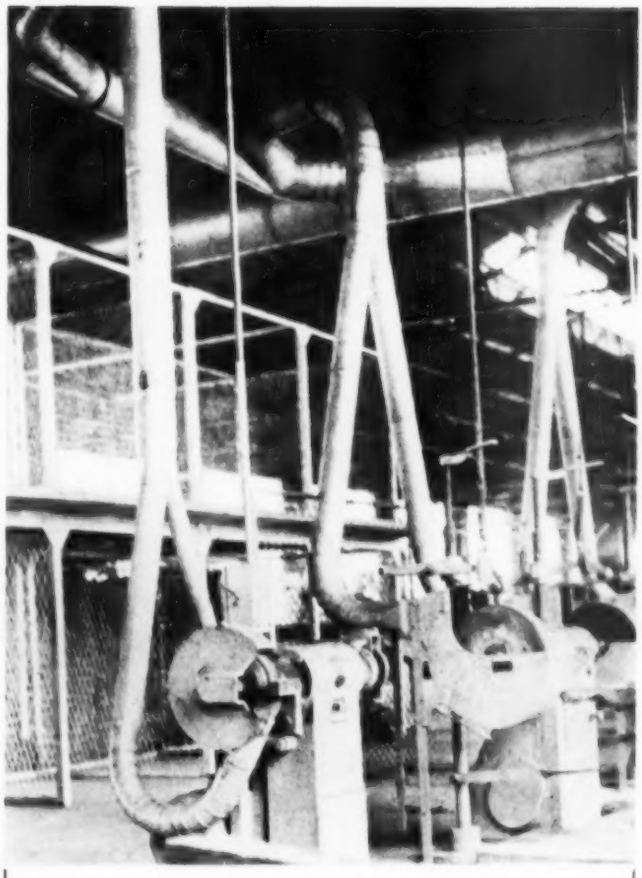
WHITING
50 YEARS OF SERVICE

KIRK & BLUM "Stream-Lined" Piping and Fittings



This illustration shows a typical installation of Kirk & Blum Streamline Fittings and One-piece Elbows—only two of the many reasons for the high efficiency of Kirk & Blum equipment.

Its proper design; rigid construction through the use of *heavy* gauge steel and adequate hangers and supports, together with correct installation—insure a most satisfactory dust collecting system.

Be sure to specify K & B Piping because it saves power and lasts longer.

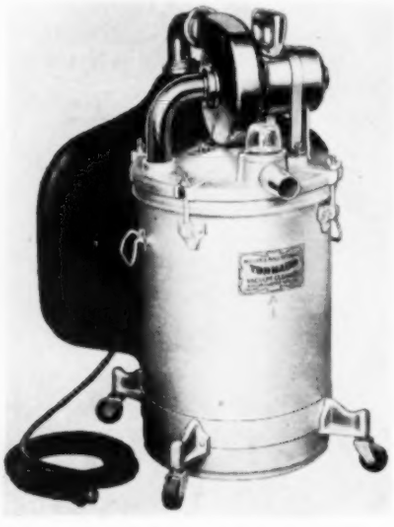
THE KIRK & BLUM MFG. CO.,
2808 Spring Grove Avenue, Cincinnati, Ohio
Detroit Factory: 4718 Burlingame
Pittsburgh Representative: The Bushnell Machinery Co., 1501 Grant Bldg.
Louisville Representative: Liberty Blow Pipe Co., Inc., 325 Roland St.

New Equipment

For Foundries

Builds Industrial Model Vacuum Cleaner

Breuer Electrical Mfg. Co., 852 Blackhawk street, Chicago, recently has introduced a new industrial model vacuum cleaner. The heavy-duty unit has a 46¼-inch water lift, weights 45 pounds, has a 12-gallon steel tank and is equipped with standard attachments for plant cleaning purposes.



Standard attachments for plant cleaning are provided

A special feature is an observation glass which allows the operator to see the dirt being removed in cleaning.

Direct Current Motors Totally Enclosed

A new line of direct-current motors designed for application where dust, dirt, moisture or other foreign matter is present in quantities, recently has been introduced by the General Electric Co., Schenectady, N. Y. The new motors are totally enclosed and fan-cooled, and are available in a wide variety of electrical and mechanical modifications, in sizes from ½ to 200 horsepower.

A system of dual ventilation is utilized. This, together with watertight conduit boxes, and labyrinth seals at the cartridge-type bearing housings protects the working parts of the motor. An internal fan draws the warm air from the windings and core and circulates it around the totally enclosed interior of the motor so that it gives up its heat to the frame and end shields. An external fan draws cool air in through mesh openings in an outer end shield and directs it over the surface of the magnet frame and inner end shields. Close clearances between the end shields and the bearing housings, and grease seals along the shaft, are said to prevent foreign particles from entering into the motor.

Changes Design Of Tumbling Mills

W. W. Sly Mfg. Co., 4700 Train avenue, Cleveland, has introduced a new line of tumbling mills, which includes several changes in design. Two of the mills are shown in the accompanying illustration. Particular features include roller bearings throughout, improved barrel construction to provide longer life and to prevent warpage under severe duty; use of worm gear speed reducer, etc., in drive; changes in exhaust system and a new door design.

Another feature with which these mills can be supplied is a combination clutch and brake. The clutch starts and stops the mill, while the brake is applied by the clutch lever to stop and hold a mill at any desired position for convenient loading an unloading. The door lock pulls the mill shell together and holds the door down securely when operating.

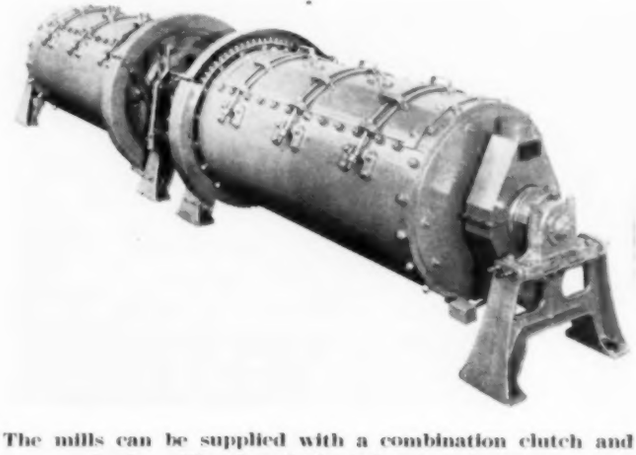
The new line of tumbling mills includes various arrangements such as single mills for belt or direct motor drive, mills arranged in single file or double file batteries as well as mills installed on elevated platforms or below the floor. The unit can be supplied with inside diameters of 24, 30, 36, 42 and 48-inches, with the inside length from 36-inches up.

Designs Blowpipe

Linde Air Products Co., 30 East 42nd street, New York, has introduced a new oxy-acetylene cutting blowpipe. Features claimed for the blowpipe are as follows: A new design of cutting oxygen valve, the valve being placed in an easily accessible position; a long external cutting valve lever which makes the valve easy to operate with the hand in normal gripping position; nozzles with seat protectors; closer spacing of heating orifices about the cutting oxygen opening; new nozzle sizes; interchangeable large-capacity ball-type inlet-needle-valves; interchangeable low-pressure injector or medium-pressure mixer.

Buys Rope Plant

Port Norris Hay Rope Co., Port Norris, N. J., recently has purchased a hay rope plant formerly operated by the Paxson-Taggert Co. and will continue the production of rope.



The mills can be supplied with a combination clutch and brake. The door lock design is a feature

Sand Mixer Pan And Spindle Revolve

Lancaster Iron Works, Lancaster, Pa., has developed a line of mulling type units for mixing foundry core and molding sands. The mixer consists of a pan revolving in a clockwise direction, a mixing spindle with its mullers and plows revolving in a counter-clockwise direction and stationary marginal plows. The mixing spindle is eccentric to the pan. The height of the mullers can be adjusted off the pan.

In the mixing operation, the material in the pan is carried in a clockwise direction, at moderate velocity, until it meets the proportionately faster counter-clockwise rotation of the mixing spindle equipment. During the travel of the material permanent bottom and side marginal plows lift and turn the material or divert it into narrow troughs to be picked up again and turned and carried forward by the spindle. In addition, the manufacturers point out that many crossing-over points are established by the relative counter currents turning the material around its vertical axis and forcing the bottom layers to the top.

The batch can be fed directly into the pan or the unit may be loaded with a full batch stationary hopper or a full batch elevator hopper. The batch is discharged through a valve located in the center of the bottom of the pan. The mixing units may be fully enclosed.

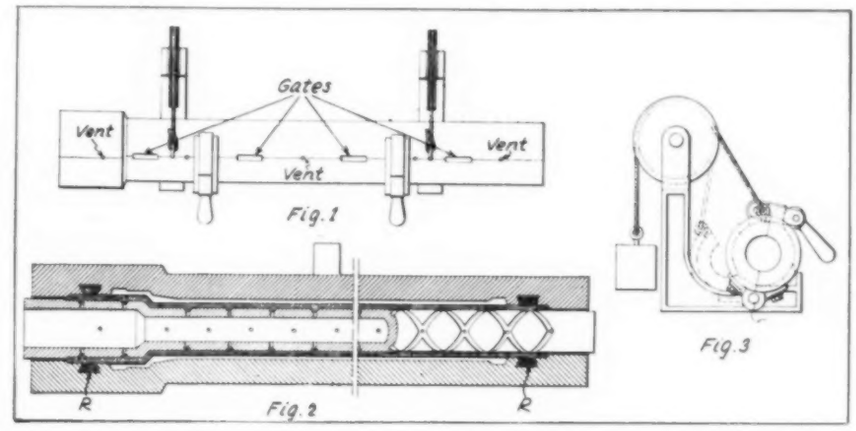
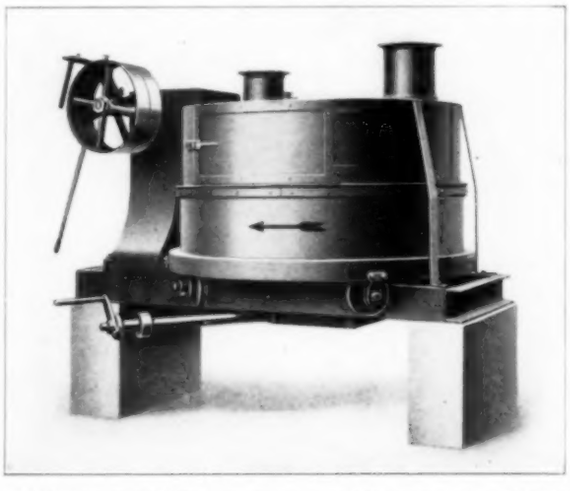


Fig. 1—Top view of closed mold showing gates and vents. Fig. 2—Longitudinal view showing construction of core and arbor. Fig. 3—Cross sectional view of mold open and closed



Mixing operations may be carried on in a totally enclosed pan

Develops Permanent Mold For Pipe Castings

Equipment and method for producing soil pipe and fittings in a permanent mold developed by Edward F. Stratton, Reading, Pa., are shown in the accompanying illustrations. A number of these molds may be set up on special supports in line with overhead monorails to facilitate pouring the metal from a four-lip ladle as in present green sand practice.

At the beginning of each day's operation the mold is heated by an acetylene torch to drive out any moisture. Then the torch is adjusted to produce a heavy smoke which is deposited over the face of the mold. The smoking process is repeated for each casting. The cores are made on hollow arbors or spindles provided with opposing helical grooves on the surface and with small vent holes at the groove intersections. A $\frac{3}{8}$-inch thickness of core sand bonded with oil or other compound is swept on the barrel as in present green sand practice. The cores are placed on suitable racks and dried. Naturally the thin coating of sand dries rapidly.

Fig. 4—The Y casting is made in a heavy cast iron hinged mold

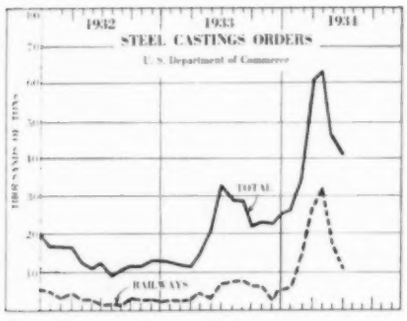
The dried core is an insurance against any sand falling in the hot mold. Also the burned sand runs readily from the resulting casting, thus eliminating any tumbling or other cleaning expense. The hot pipe leaving the mold may be dipped immediately into the pitch bath.

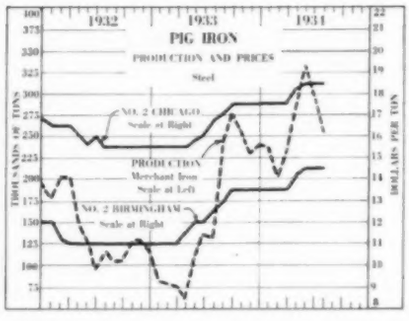
As will be noted in the illustrations the mold is made and set up horizontally in two parts with the parting line in a vertical instead of the usual horizontal position. The half molds are joined at the bottom by suitable hinges and provided with suitable locking devices at the top. One half the mold remains stationary at all times, while the second half swings open on the hinges for the removal of the casting. This swinging action is facilitated by a counterweight attached to one end of a cable which passes over a pulley and is attached by the other end to the swinging half of the mold. This feature is shown in detail in Fig. 3.

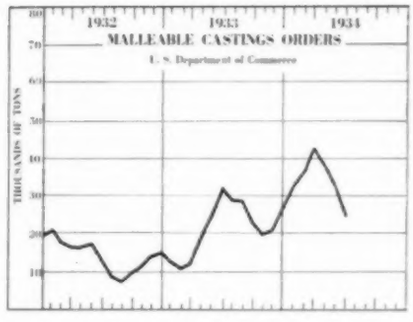
To provide a certain elasticity in the core prints at either end of the mold, an asbestos ring projects slightly above the surface. This ring which is held in a dovetail groove in the iron mold is shown distinctly at *R* Fig. 2. With slight modification in the construction of the cores the molds for making the fittings are constructed and operated in the same manner as the molds for the straight sections. One of the molds for a Y, also the resulting casting are shown in Fig. 4.

Elected President

Maj. Aaron E. Carpenter, formerly first vice president, recently was elected president and general manager of the E. F. Houghton & Co., Philadelphia. Other officers are as follows: George W. Pressell, vice president and director of sales; A. Everly Carpenter, 3rd, secretary; Dr. R. H. Patch, treasurer; C. P. Stocke, assistant secretary; Miss M. M. Menningen, assistant treasurer.







Foundry Activities

Reflect Industrial Trends

SCHUMACHER-KELLY CO. INC., Freehold, N. J., recently was organized to purchase the John H. Bawden Foundry. The property is being renovated and it is anticipated that the plant will be in operation the latter part of August. E. W. Schumacher is president, M. J. Kelly, vice president, C. F. Schumacher, secretary and C. F. Kelly is treasurer. The foundry was founded in 1856 by the late John H. Bawden and Gilbert Combs and at one time was engaged extensively in the manufacture of Fraklin stoves.

* * *

Output of castings from foundries in the Philadelphia Federal Reserve district increased in June for the seventh consecutive month according to reports received by the Industrial Research department of the University of Pennsylvania. The increase was 4.1 per cent over May. Production of malleable castings increased 14 per cent. Activities of gray iron foundries declined 7 per cent.

* * *

Bluffton Foundry & Machine Co., Bluffton, Ind., has been incorporated by William Moser, Ray Ash, George Lautzenhiser and Fred Moser to purchase the Grimes Machine Co. George Lautzenhiser will be manager of this company which will specialize in oil drilling and pumping equipment.

* * *

Commonwealth division, General Steel Castings Corp., Granite City, Ill., recently received an order for car frames which has necessitated the employment of about 400 additional men. The order is for one-piece cast steel underframes for one thousand 70-ton flat cars.

Pressure Castings Inc., manufacturer of die castings, formed early this year, is operating two shifts in its plant in the F. B. Stearns building, Euclid avenue and Lake View road, Cleveland. David Benjamin, president of the Gabriel Co., is president.

* * *

James D. Johnson recently was appointed receiver for the Decatur Malleable Iron Co., Decatur, Ill., by the circuit court. It is reported the receiver will make no effort to operate the plant, although operations may be resumed sufficiently long to fill current orders.

RAW MATERIAL PRICES
Aug. 6, 1934

Iron	
No. 2 foundry, Valley	$18.50
No. 2 Southern, Birmingham	14.50
No. 2 foundry, Chicago	18.50
No. 2 foundry, Buffalo	18.50
Basic, Buffalo	17.50
Basic, Valley	18.00
Malleable, Chicago	18.50
Malleable, Buffalo	19.00
Charcoal iron, furnace	21.00
Coke	
Connellsville beehive premium	$5.10
Wise county beehive coke	3.50 to 4.25
Detroit by-product coke	8.50
Scrap	
Heavy melting steel, Valley	$11.50 to $12.00
Heavy melting steel, Pitts.	11.75 to 12.25
Heavy melting steel, Chicago	9.00 to 9.50
Stove plate, Buffalo	8.50 to 9.00
Stove plate, Chicago	6.50 to 7.00
No. 1 cast, New York	6.50 to 7.75
No. 1 cast, Chicago	8.50 to 9.00
No. 1 cast, Pittsburgh	13.00 to 13.50
No. 1 cast, Philadelphia	11.00 to 12.00
No. 1 cast, Birmingham	10.00 to 10.50
Car wheels, iron, Pittsburgh	11.25 to 11.75
Car wheels, iron, Chicago	9.75 to 10.25
Railroad malleable, Chicago	9.25 to 9.75
Malleable, Buffalo	12.00 to 12.50
Nonferrous Metals	**Cents per pound**
Casting copper, refinery	8.75
Straits tin	51.70
Aluminum, No. 12, producers	18.00 to 22.00
Aluminum, No. 12 (Standard)	14.00
Lead, New York	3.75
Antimony, New York	8.25
Nickel, electro	35.00
Zinc, East St. Louis, Ill.	4.30

* * *

Duriron Co., Dayton, O., manufacturer of acid and alkali handling equipment, is erecting an extension to its alloy steel foundry which will double the size of plant. Equipment including additional electric induction furnaces will be installed.

* * *

Hoffman Foundry Co., Manitowoc, Wis., formed by Edward Hoffman, has leased the plant of the Richards Iron Works, Ninth and Commercial streets, and will conduct a general foundry business.

* * *

Index of orders for foundry equipment in June was 70.4 as compared with 66.3 in May and 45.5 June, 1933, according to a recent report of the Foundry Equipment Manufacturers association.

* * *

D. R. C. Foundry Co., Kalamazoo, Mich., recently was damaged by fire which started in the flask storage at the rear of the foundry.

* * *

Ecorse Foundry Co., Ecorse, Mich., has been incorporated to conduct a general foundry business, by John M. Grinnian, 1700 Fisher building, Detroit.

* * *

Levitt-Ulmer Corp., Detroit, recently has been incorporated by Edward H. Levitt, 2510 David Scott Building.

* * *

American Casting Co., Birmingham, Ala., was damaged by fire to the extent of $2500 recently.

* * *

Best Foundry Co. plant, Bedford, O., recently was dismantled.

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New Trade Publications

DUST COLLECTORS — Pangborn Corp., Hagerstown, Md., recently has published a well illustrated booklet on its all metal cloth screen dust collector. The booklet presents as special features of the equipment a phantom photograph showing the complete assembly of the units, illustrations showing the wire mesh screen frames, the method of installing the filter cloth bags, the screen rapping mechanism, and other points of design. Tables give specifications for several different sizes of units.

BRONZES—Ampco Metal Inc., South Thirty-ninth and West Burnham streets, Milwaukee, has issued a catalog on its line of bronzes. The publication presents a description of the various grades of the metal produced, and discusses applications for the various types. The catalog is well illustrated showing the foundry and machine shop facilities of the company as well as various types of tools and other machinery on which the bronzes are employed.

IDLERS—C. O. Bartlett & Snow Co., 6200 Harvard avenue, Cleveland, has issued a bulletin on its belt conveyor idlers. Illustrations show the design and construction of the various idlers and reproductions of photographs show a number of interesting applications. A portion of the booklet is devoted to flat belt conveyor idlers used in systems to distribute tempered sand to molders in the foundry.

ROLLER BEARINGS—Bantam Ball Bearing Co., South Bend, Ind., has issued a catalog on its line of taper roller bearings. Over 1500 bearings are listed in detail and other types are shown which can be supplied in standard or special sizes. A table giving safety factors for 33 different types of service and a concise speed capacity chart for all types of tapered roller bearings are included.

ROTARY SWITCHES—A new line of rotary switches is described in a recent catalog of the Roller-Smith Co., 233 Broadway, New York. The instrument switches are designed for use with electrical measuring instruments and the control switches are used for establishing proper connections to air and oil circuit breakers and other equipment of that nature.

TUMBLING MILLS—W. W. Sly Mfg. Co., 4700 Train avenue, Cleveland, recently has issued an attractive bulletin describing and illustrating improvements which have been made on its line of tumbling mills. The discussion refers especially to the method of exhausting the mill, the means of locking the door, drives, and arrangement for loading and unloading.

DEMAND CONTROL—Standard Electric Time Co., Springfield, Mass., has published a bulletin on its maximum demand control equipment. The equipment is not designed to retard production, but is provided to warn in advance the approach of a new high peak. Demand control may be accomplished from more than one load center through the use of the equipment.

REFRACTORY BRICK—A refractory brick, calcined for use at temperatures up to 2000 degrees Fahr. is discussed in a recent bulletin of the Johns-Manville, 22 East Fortieth street, New York. Fatures discussed include conductivity, spalling, strength, deformation under temperature, permeability, and expansion. Performance data also is included.

OPTICAL EQUIPMENT—Bausch & Lomb Optical Co., Rochester, N. Y., has issued a booklet on "The Light Benders," which gives interesting information on optical equipment, microscopes, cameras, telescopes, and a variety of other products which are manufactured by that company. Considerable historical information is presented.

DUST COLLECTORS — Prat-Daniel Corp., New York, has published a booklet on its multi-cyclone dust collectors. The equipment consists of a battery of small diameter cyclone arresters, each having individual control by dampers so that the number of units in operation fluctuates as the gas laden dust increases or decreases.

GAGGERS—Twisted soft steel gaggers of grooved, square sections are described and illustrated in a recent bulletin of the Franklin Steel Works, foundry gagger department, Franklin, Pa. Information is presented on the theory of gagger construction and the advantages claimed for the particular type manufactured by that company.

FURNACE BLOCKS — Johns-Manville, 22 East Fortieth street, New York, has published a bulletin on its line of refractory blocks for use with temperatures ranging up to 1900 degrees Fahr. Photographs show the method of installation and the text discusses the advantages claimed for that material.

FURNACES—United Furnace Engineering Co. Inc., 90 West street, New York, has published a bulletin on its recently developed crucible type oil fired furnace for melting nonferrous metals. Information is presented on the method of operation and illustrations show the design and installations of the unit.

RESPIRATORS — Pulmosan Safety Equipment Co., 176 Johnson street, Brooklyn, N. Y., has prepared a bulletin on its line of dust respirators. Descriptions and illustrations of six different models are presented, and new features incorporated in the equipment are listed.

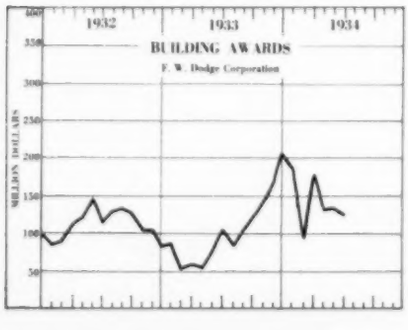
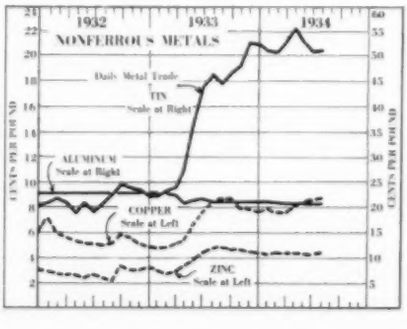
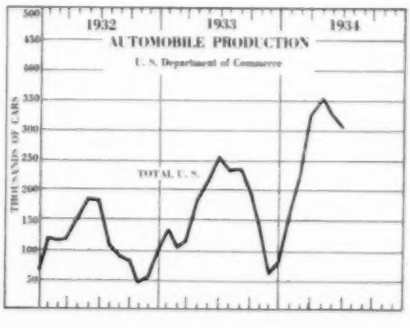
FLEXIBLE COUPLINGS — Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has published a bulletin on its new general purpose couplings designed for use in connection with gearmotors, speed reducers, and other industrial drives.

TUBE COUPLINGS—Parker Appliance Co., 10320 Berea road, Cleveland, has issued a bulletin on its line of tube couplings and associated equipment, which includes valves, cocks, tubing, heat exchangers, etc.

AIR COMPRESSORS — Worthington Pump & Machinery Corp., Harrison, N. J., has published a bulletin on its feather valve compressors. Illustrations show two different types of machines as well as several installations.

MOTOREDUCERS—Falk Corp., Milwaukee, recently has published a bulletin on its line of vertical motoreducers. The text includes features of design of the equipment, and tables showing dimensions and thrust capacities.

ROPE DRIVES—Medart Co., 3500 De Kalb street, St. Louis, has published a catalog on its line of V-belt drives in sizes ½-horsepower and over.

Faked Foundry Facts

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